SCOTT RIVER IRONSTONE ASSOCIATION

INTERIM RECOVERY PLAN

2004-2009

Robyn Luu[1] & Val English[2]

[1] Project Officer, Species & Communities Branch, Department of Conservation and Land Management (CALM), PO Box 51 Wanneroo, 6946.

[2] Acting Senior Ecologist, Species & Communities Branch, CALM, PO Box 51 Wanneroo, 6946.

Photograph: Greg Keighery

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Department of Conservation and Land Management
Species & Communities Branch (SCB)
PO Box 51, Wanneroo, WA 6946

Government of Western Australia

DEPARTMENT OF Conservation AND LAND MANAGEMENT
Conserving the nature of WA

FOREWORD

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

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

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

This Interim Recovery Plan will operate from September 2004 to August 2009 but will remain in force until withdrawn or replaced. It is intended that, if the ecological community is still ranked 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 21 November 2005 and was approved by the Director of Nature Conservation 13 December 2005. The allocation of staff time and provision of funds identified in this Interim Recovery Plan is dependent on budgetary and other constraints affecting CALM, as well as the need to address other priorities.

Information in this IRP was accurate at September 2004.

ACKNOWLEDGMENTS

The Endangered status of the Scott River ironstone community was identified under the Australian Nature Conservation Agency funded project entitled 'Identifying and conserving threatened ecological communities in the South West Botanical Province' (English and Blyth 1997a).

The following people provided valuable advice and assistance in the preparation of this Interim Recovery Plan;

Neil Gibson	Senior Research Scientist, CALM's Science Division
Greg Keighery	Principal Research Scientist, CALM's Science Division
Mike Lyons	Research Scientist, CALM's Science Division
Russell Smith	Botanist, CALM's South West Region
Andrew Webb	Nature Conservation Officer, CALM's Blackwood District
Kim Williams	Program Leader Nature Conservation, CALM's South West Region
Lisa Wright	Librarian, CALM's Science Division

SUMMARY

Name: Scott River Ironstone Association

Description: Winter wet shrubland that occurs on skeletal soils over the massive ironstone on the Scott Coastal Plain. Heath and shrublands are variously dominated by *Melaleuca preissiana*, *Hakea tuberculata*, *Kunzea micrantha* or *Melaleuca incana* subsp. Gingilup depending on the degree of waterlogging. The understorey is generally dominated by *Loxocarya magna*.

CALM Region: South West

CALM District: Blackwood

Local Government Authorities: Nannup, Augusta-Margaret River

Recovery Team: South West Region Threatened Flora and Communities Recovery Team. Membership: representatives from CALM's South West Region (Chair) and Blackwood District, Environmental Office Shire of Busselton, Bunbury Naturalists Club, and CALM's WA Threatened Species and Communities Unit. The Recovery Team will report annually to CALM's Corporate Executive.

Current status: Assessed 18 July 1996 as Endangered.

Habitat requirements: The community is located upon skeletal soils developed over massive ironstone and undergoes seasonal inundation with fresh water. Many taxa in the community are highly restricted in distribution, dieback susceptible and/or are obligate seeders.

Critical habitat: The critical habitat for the Scott River Ironstone community is the ironstone soil type, and the surface, groundwater and groundwater catchment that maintains the hydrology of the remaining vegetation on the Scott River Ironstone.

Habitat critical to the survival of the species, and important populations: Given that this community is listed as threatened it is considered that all known habitat is habitat critical and all occurrences important ones.

Benefits to other species/ecological communities: Most occurrences of the Scott Ironstone community contain a number of listed and priority flora. Recovery actions implemented to improve the quality or security of the community are likely to improve the status of any species within the community, as well as the rare and priority flora.

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

Role and interests of indigenous people: According to the Department of Indigenous Affairs Aboriginal Heritage Sites Register and an investigation into the Aboriginal significance of wetlands and rivers in the Busselton-Walpole Region (O'Connor *et al*. 1995), there are a number of registered sites (engraving - Dunnet's Farm; artefacts - Scott River Trench, Brennan Ford/Scott River) known from the vicinity of occurrences of the Scott Ironstone community. Indigenous communities interested or involved in the region affected by this plan have not yet been identified, however, implementation of recovery actions under this plan includes consideration of the role and interests of indigenous communities in the region.

Social and economic impacts: The implementation of this recovery plan has the potential to have some social and economic impact as some occurrences are located on private property, and other areas of land managed for purposes other than conservation. 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. There are mineral exploration and extraction leases over of areas of land that contain most occurrences of the TEC. Recovery actions refer to continued liaison between stakeholders with regard to these areas.

Evaluation of the Plans Performance: CALM, in conjunction with the South West Region 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 / recovery actions will be documented accordingly.

IRP Objective(s): To maintain or improve the overall condition of the plant community in the known locations and reduce the level of threat.

Criteria for success:

- An increase in the area of this community under conservation management.
- Maintenance in terms of diversity and basic composition of native species (as described in Gibson *et al.* 2000) as well as hydrological and biological processes, taking account of natural change of the community over time, as indicated by monitoring.
- Improvement in terms of reduction of numbers of, and area covered by, exotic species and of other threatening processes as defined in this document, as indicated by monitoring.

Criteria for failure:

- Significant loss of area or further modification of occurrences of the threatened ecological community.

Recovery Actions:

1. Coordinate recovery actions	14. Monitor weeds
2. Map critical habitat	15. Implement weed control
3. Liaise with relevant land managers	16. Develop strategy for ex-situ propagation
4. Survey and describe new ironstone occurrences	17. Design and conduct research
5. Monitor the extent and boundaries of occurrences	18. Report on success of management strategies for the community
6. Disseminate information about the community	19. Review the need for a full Recovery Plan
7. Install markers	20. Seek to improve conservation status of occurrences on public land
8. Design and implement a program for monitoring flora	21. Develop a management plan for the community on road reserves
9. Confirm the presence of dieback disease and monitor	22. Fence occurrences on road reserves if deemed necessary
10. Implement dieback treatment	23. Seek to fence occurrences on private land, where appropriate
11. Prevent the further spread of dieback	24. Access funding incentives for conservation
12. Develop and implement a Fire Management Strategy	25. Seek to acquire community on private land
13. Monitor water quality and levels	

1. BACKGROUND

1.1 History, defining characteristics of ecological community, and conservation significance

The ironstone soils are extremely restricted in distribution on the Scott River Plain. These soils may have been historically associated with bogs - the iron being deposited by water percolating through the soil and bacterial action on the surface (de la Hunty 1960; Tille and Lantzke 1990 b, c, d and e) and/or as a result of precipitation of iron oxides associated with fluctuating groundwater levels (Baddock 1995). Recent research also indicates that the characteristics of ironstone are likely to have been influenced by the plant community that historically occurred on these wetlands. Further, certain lateritic soils may have been partly derived from iron-rich complexes generated by roots of proteaceous plants (Pate *et al*. 2001).

Restricted areas of massive ironstone associated with unusual plant communities occur in a number of areas in the southwest of Western Australia; in the Scott River area, Gingin and Busselton (Gibson *et al.* 1994; Gibson *et al*. 2000). Each of these areas contains plant communities that are characterised by different taxa.

Tille and Lantzke (1990d, 1990e) mapped the ironstone in the Scott River area. Gibson *et al*. (2000) determined from this mapping that the original extent of the community was about 1780 hectares. Currently about 325 hectares remain uncleared. This represents a loss of 82 percent of the area of a plant community that was originally highly restricted in distribution.

Currently, there are only approximately 126 hectares of the community found on public lands. Of this, 82 hectares are in Nature Reserves, 2 hectares are in State Forest and National Park, and about 42 hectares are on lands with the care, control and management placed in other authorities, mainly the Shire of Augusta-Margaret River. Another 200 hectares of the community occur on private land. Areas of threatened ecological communities that occur in State Forest are planned to be managed for their conservation or recovery as recommended in English and Blyth (1997a). Statements held in CALM's new draft Policy Number 9 are to guide management of all threatened ecological communities that occur on lands managed by CALM.

The ironstone soils near Augusta are associated with seasonal inundation with fresh water. This inundation may occur due to ponding of rainfall as a consequence of the impermeable nature of the surface outcrops of ironstone and the associated heavy soils. In addition, groundwater levels in the community come very close to or may reach the surface in the wetter months (Tille and Lantzke 1990 a, b and c).

The heath and shrublands of the ironstone are variously dominated by *Melaleuca preissiana*, *Hakea tuberculata*, *Kunzea micrantha* or *Melaleuca incana* subsp. Gingilup depending on the degree of waterlogging. The understorey is generally dominated by *Loxocarya magna*. All occurrences, except the long inundated wetlands and dense thickets, have very diverse annual flora of *Stylidium* spp., *Centrolepis* spp., *Schoenus* spp., and *Brizula* spp. etc. A list of taxa that include those which occur in at least two sites (from Gibson *et al.* 2000) is given in Appendix 1.

It is not known to what extent fire has influenced the present structure or composition of the community. Grazing, where it occurred, would almost certainly have increased the invasion of exotic species within the community. However, weed cover in most occurrences is currently very low.

The community contains a number of taxa that are listed as Priority or Declared Rare Flora (DRF) (Atkins 2003; refer Table 1) and are either restricted or largely restricted to it (Gibson *et al*. 2000). As mentioned, another area of ironstone soils occurs on the Swan Coastal Plain near Busselton, and some of the taxa that are confined to ironstone soils occur in both these areas. Only four of the 20 taxa listed in this table are common to both areas however, and the plant communities are considered to be quite distinct.

Table 1: Taxa restricted or largely restricted to ironstone soils of the Swan, and Scott Coastal Plain (from Gibson *et al*. 2000) (Definitions of DRF and Priority ratings for plant taxa occur in the Glossary)

Taxon	Priority Listing (Atkins 2003)	Swan Coastal Plain ironstone	Scott Coastal Plain
Andersonia ferricola ms	P1	+[E]	
Gastrolobium modestum	DRF	+	
Gastrolobium papilio	DRF	+[E]	
Chamelaucium roycei ms	DRF	+	
Darwinia sp. Williamson (GJ Keighery 12717) [aff. *apiculata*]	DRF	+[E]	
Dryandra squarrosa subsp. *argillacea*	DRF	+[E]	
Grevillea elongata	DRF	+[E]	
Grevillea maccutcheonii	DRF	+[E]	
Hakea oldfieldii	P3	+	
Lambertia echinata subsp. *occidentalis*	DRF	+[E]	
Petrophile latericola ms	DRF	+[E]	
Dryandra nivea subsp. *uliginosa*	DRF	+[E]	+
Calothamnus sp. Scott River (RD Royce 84) [aff. *crassus*]	P2	+[E]	+
Chordifex isomorphus	P4	+	+
Loxocarya magna	P3	+	+
Darwinia ferricola ms	DRF		+[E]
Grevillea manglesioides subsp. *ferricola*	P2		+[E]
Hakea tuberculata	P3		+
Lambertia orbifolia subsp. Scott River Plains	DRF		+[E]
Melaleuca incana subsp. Gingilup (N Gibson & M Lyons 593)	P2		+[E]

[E] = Endemic

Table 2. Extent and location of occurrences

Occurrence Number	Location	Land Tenure	Estimated area
Occurrence 1	Gingilup Swamps Nature Reserve (NR) 30626 (GSNR8, GSNR9)	Nature Reserve	40 ha
Occurrence 2	Mileanup Road Scott River (SCOTT02NTH)	Private Property and Unallocated Crown land	4.5 ha
Occurrence 3	Scott NP A25373; Reserve A12951; Scott River banks NR C42942 (SR19, SRFE01, SRFE02)	National Park, Camping Reserve and Nature Reserve	19.25 ha
Occurrence 4	Dennis Road Scott River (MYDENIS01)	Road Reserve	0.5 ha
Occurrence 5	Dennis Road; Chester Forest Block (CHESTER01, MYDENIS02)	Road Reserve, State Forest	1.25 ha
Occurrence 6	Private land Scott River (MY4155STH)	Private Property	7 ha
Occurrence 7	Private land Scott River	Private Property	14 ha

	(MY4155WEST)		
Occurrence 8	Private land Scott River (MY4155CNTR)	Private Property	4 ha
Occurrence 9	Private land Scott River (MY4155NTH)	Private Property	3 ha
Occurrence 10	Private land Scott River (MY4155EAST)	Private Property	1.5 ha
Occurrence 11	Private land Scott River; Governor Broome Road (MY4156)	Private Property and Road Reserve	73 ha
Occurrence 12	Reserve A12951; Private land Scott River (MY12951SE)	Camping Reserve and Private Property	15 ha
Occurrence 13	Reserve A12951; Governor Broome Road (SRFE03)	Camping Reserve and Road Reserve	2 ha
Occurrence 14	Governor Broome Road (MYGVBMN1)	Road Reserve	0.06 ha
Occurrence 15	Governor Broome Road (MYGVBMN2)	Road Reserve	0.4 ha
Occurrence 16	Governor Broome Road (MYGVBMS2)	Road Reserve	0.4 ha
Occurrence 17	Governor Broome Road (SRFE04)	Road Reserve	1.5 ha
Occurrence 18	Governor Broome Road (MYGVBMS3)	Road Reserve	1.5 ha
Occurrence 19	Governor Broome Road (MYGVBMN4)	Road Reserve	0.1 ha
Occurrence 20	Governor Broome Road; private land Scott River (MYGVBMN5)	Road Reserve; Private Property	0.6 ha
Occurrence 21	Governor Broome Road; private land Scott River (MYGVBMN6)	Road Reserve; Private Property	2 ha
Occurrence 22	Governor Broome Road (MYGVBMS6)	Road Reserve	0.15 ha
Occurrence 23	Private land Scott River (MY4264NTH)	Private Property	15 ha
Occurrence 24	Private land Scott River (MY4264STH)	Private Property	62 ha
Occurrence 27	Private land Scott River (MY4262NTH)	Private Property	3.5 ha
Occurrence 28	Private land Scott River (MY4262W)	Private Property	1 ha
Occurrence 29	Private land Scott River (MY4262CN1)	Private Property	2 ha
Occurrence 30	Private land Scott River (MY4262CN2)	Private Property	1.5 ha
Occurrence 32	Private land Scott River (MY2973)	Private Property	4 ha
Occurrence 33	Scott River Road (MYSCTRDW)	Road Reserve	1 ha
Occurrence 34	Scott River Road (MYSCTRDE)	Road Reserve	0.3 ha
Occurrence 38	Private land Scott River	Private Property	1.5 ha

	(MY4264W)		
Occurrence 39	Reserve C42377 (MY42377)	Nature Reserve	42 ha

Note: Occurrences 25, 26, 31, 35, 36 and 37 have been cleared

1.2 Description of Occurrences

Occurrence 1 is located on the central northern section of Gingilup Swamps Nature Reserve 30626. This occurrence was burnt in 1993, and a very hot fire wildfire occurred in January 2001. There is a track through the middle of this occurrence of the ironstone community.

Occurrence 2 straddles Mileanup Coast Road. The southern portion has been highly modified by partial clearing and grazing. Little understorey is present and weeds occur throughout the occurrence.

Occurrence 3 occurs in Scott River National Park, Camping (Shire) Reserve A12951 and Nature Reserve C42942 on the banks of the Scott River. This occurrence was illegally burnt in 1995.

Occurrences 4 and 5 occur on Dennis Road and extend into the Chester Block of State Forest. Both occurrences are subject to frequent illegal burning by local landowners. The road is used as a main haulage route for trucks and this activity has the potential to spread dieback disease into the road reserve, and possibly into the adjacent forest block, and impact on the habitat. Road maintenance activities include grading, chemical spraying, construction of drainage channels and the mowing of roadside vegetation. Several of these actions encourage weed invasion.

Occurrences 6-10 are located on private property, near the Scott River. These occurrences have not been surveyed and it is possible that they have not been fenced and are being grazed.

Occurrence 11 is on private property south of Governor Broome Road. This is the largest and best single occurrence of the Scott ironstone community. Although the area is not fenced and cattle able to access the site, the stocking rate is very low and therefore there appears to be no visible impact on the community from grazing at present. The landowner currently does not wish to sell this area but it is possible that the site may become available in the future and may be possible to acquire as a conservation reserve.

Occurrences 12-13 are on Camping Reserve A12951, extending on to private property, and on to Governor Broome Road. Kangaroos are having a significant impact on the camping reserve through trampling and grazing the vegetation. The road is also being used as a route for stock which trample and break foliage when moving through the area. The part of the occurrence that extends on to private property has not been surveyed and it is possible that it is not been fenced and is being grazed.

Occurrences 14-22 occur on Governor Broome road reserve and extend on to private property. The vegetation along the road reserve is frequently illegally burnt and it is not known what impact this has had on the reserve. The road is also being used as a route for stock which trample and break foliage when moving through the area. Apart from increasing nutrients in the soil through their droppings and subsequent potential for weed invasion, the cattle may also introduce and spread dieback disease. Around 1998 some of the ironstone vegetation was cleared to install a new powerline along the road reserve. Powerline maintenance may result in clearing of additional vegetation and destruction of DRF species, weed invasion and the introduction and spread of dieback disease.

Occurrences 20-21 occur on private land north of Governor Broome Road. These occurrences have not been surveyed and it is possible that they have not been fenced and are being grazed.

Occurrences 23-24 occur north of Governor Broome Road. This land was previously owned by BHP Billiton, but has recently been transferred back to the State. The area is planned to be placed under the care, control and management of the Conservation Commission in future. Deaths of the DRF species, caused by *Phytophthora* species have been detected in both these occurrences. The area is fenced to

prevent access by stock. Kangaroos are having a significant impact on this area by trampling and grazing the vegetation.

Occurrences 27-32 occur on private property, north and south of Governor Broome Road. These occurrences have not been surveyed and it is possible that they have not been fenced and are being grazed. Some occurrences of the community that were adjacent to these have recently been cleared for agriculture.

Occurrences 33-34 occur on Scott River Road reserve, adjacent to the Scott River National Park on the west side of the road, and on private property. These occurrences are in good condition with some impact from fire and road maintenance.

Occurrence 38 occurs on private property, adjacent to Scott River Road. This occurrence has not been surveyed and it is possible that it has not been fenced and is being grazed.

Occurrence 39 occurs in Nature Reserve C42377, which is surrounded by cleared agricultural land. In 1990 an area of the Scott ironstone community, including a number of DRF, on private property was cleared. Part of this area (approximately 40 hectares) was purchased in 1991 and placed under the care, control and management of the Conservation Commission. This area was then fenced to prevent access by stock. Kangaroos are having a significant impact on this reserve through trampling and grazing the vegetation.

Data on all known occurrences of threatened ecological communities are held in the threatened ecological communities database at CALM's Wildlife Research Centre, Woodvale.

1.3 Biological and ecological characteristics

The ironstone soils of the Scott Coastal Plain are seasonally inundated (surface water in wetter months). Many of the plant taxa present, including priority and DRF species, are restricted to sites that experience seasonal inundation eg. *Darwinia ferricola* ms (DRF). The characteristic herb layer is also likely to rely on inundation in the wetter months. The occurrences of the Scott River Ironstone Association are highly variable in floristic composition. This level of variation appears to be quite closely linked to soil depth and type.

Gibson *et al*. (2000), analysed data from 16 floristic plots to identify different 'sub-communities' on the ironstones of the Scott River Plain. In this plan, these are all considered to be sub-communities of the Scott River Ironstone Association. These include:
Community type 4 consists of the species rich (average of 50.7 species per plot) vegetation on massive ironstones of the Scott Plain. It is differentiated by the occurrence of *Calothamnus* sp. Scott River and *Velleia trinervis* (eg Occurrences 23, 24).
Community types 5 and 6 occur on the Scott Plain on more sandy substrates over massive ironstone. Community type 5 is species rich (average of 44.0 species), compared to community type 6 (average of 27.0 species). Community type 6 occurs close to the coast, which is reflected by the presence of *Agonis flexuosa*.
Community type 8 occurs on massive ironstones on the Scott Coastal Plain. This community type typically is a dense tall shrubland with low species richness (average of 27.3 species). The dense, closed nature of the community prevents the rich and diverse herb flora that is seen in the more open community type 4 which occurs on similar massive ironstones elsewhere on the Scott River Plain.
Community type 9 is a single occurrence found in Gingilup Nature Reserve and consists of deep winter wet swamp dominated by the ironstone endemic *Melaleuca incana* subsp. Gingilup. Species richness is low (average of 14.0 species), apparently restricted by the long period of inundation (up to 30-50cm) which extends well into the summer. Species typical of winter wet swamps such as *Hakea linearis*, *Baumea juncea*, *Meeboldina scariosa*, *M. tephrina* ms and *Platychorda applanata*, occur in this site.

Since this research was undertaken, a number of additional ironstone occurrences have been located which may not correspond to the community types listed above. These community types consist of low

Banksia (*B. grandis*, *B. littoralis*, *B. ilicifolia*) woodland on the coast and on the bank along the Scott River.

1.4 Hydrology

Historically, water levels have been very close to the surface where the ironstone occurs, although seasonal inundation is limited to shallow surface water during the winter months (Tille and Lantzke 1990 b and c). Inundation usually persists for a period of around three months, although some occurrences may typically have little surface water.

A suite of aquifers (or 'formations') within sand or sandstone occur beneath the Scott Ironstone Association. Shales, siltstones and clays occur between these aquifers and restrict the vertical and lateral flow of water to varying degrees. The aquifers present in the Scott Coastal Plain, from the surface are: the superficial formation; Warnbro Group; Parmelia formation; Yarragadee formation; Cockleshell Gully formation; the Lesueur formation; and the Sabina sandstone and Sue Coal Measures (URS 2003).

The major aquifer of the Scott Coastal Plain is the south west Yarragadee Formation. This aquifer has an average groundwater salinity of less than 500 mg/L. It is recharged through infiltration of rainfall on outcrop areas and through leakage from overlying aquifers. Groundwater flows mostly southwards in the general area. Superficial formations also form an unconfined aquifer about 10 m thick on the coastal plain (Baddock 1995), and shallow lateral groundwater flow is also predominantly towards the south (URS 2003).

It is likely that the hydrology of the Scott Ironstone, hence the persistence of the associated plant community, would depend primarily on the superficial aquifer. The Scott Wet Ironstone soils occur at the interface between the Yarragadee and the portion of the Leederville aquifer termed the 'Leederville 2c'. The potential risk of impact from changes to groundwater levels in these areas is moderate to high (URS 2003). URS (2003) state that the maintenance of the Scott Ironstone Association may be influenced by the Yarragadee Formation, depending on the hydraulic connection between the superficial and the Yarragadee formations beneath the Scott Coastal Plain. The level of connection between the aquifers is not known.

As a consequence of the influence that seasonal variations in water levels have on determining the ecology of the Scott Ironstone Association, minor changes to water levels or quality may have a significant impact on the ironstone community and component endemic flora. The level of change in groundwater levels that this community can tolerate is not known, and extensive investigation would be required to clarify this.

URS (2003) state that it is likely that drying as a consequence of climate change will decrease the water levels in the superficial aquifers, and that any additional impacts of lowering of groundwater as a consequence of abstraction will exacerbate these changes. The likelihood that groundwater decline would impact on the Scott Ironstone communities is relatively high (URS 2003). The impacts to ecological integrity may be slight in the short term, but increase over time (URS 2003).

Many occurrences of the Scott Ironstone Association occur in areas in which water levels in the Yarragadee aquifer are in decline as a consequence of abstraction for agricultural use (URS 2003). Few are in areas where the levels of this aquifer are mapped as 'stable', with the exception being Occurrence 1 in Gingilup Swamps Nature Reserve (URS 2003). There is currently no monitoring in place to provide information about the water regime of the Scott Ironstone Association, and apparently no plans to complete this work, even though current levels of abstraction from the Yarragadee aquifer are about 7.8 gigalitres (GL) per year, mainly from the Scott Coastal Plain (URS 2003). All occurrences of the Scott Ironstone Association occur in areas where the water levels in the superficial aquifer are mapped as stable, and all but Occurrence 1 occur in areas where the Leederville aquifer is mapped as stable (URS 2003).

1.5 Soils and Landform

Tille and Lantzke (1990 b, c, d and e) mapped the soils and landforms on private land in the Busselton-Margaret River-Augusta area, and the following descriptions are from those publications. The majority of occurrences of the community are located within the Scott River Plain land system, consisting of 'Scott Wet Ironstone Flats' (Swi) described as poorly drained flats and depressions with lateritic boulders and outcrop and bog iron ore soils; four occurrences (39, 5, 2 and 1) occur on patches of 'Scott Deep Sandy Flats' (Sd) (extensively poorly drained flats with bleached sands), 'Scott Deep Sandy Wet Flats' (Swd) (extensive flats and depressions with very poor drainage and wet sands), and 'Scott Deep Sandy Gentle Rises' (Sd2) (small sandy rises or dunes with bleached sands). Occurrence 2 is located on 'Scott Ironstone Rises' (Si) described as small raised knolls with laterite outcrop and shallow reddish sands.

1.6 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* (EPBC Act)).

The critical habitat for the Scott River ironstone community comprises:

- the area of occupancy of known occurrences;
- areas of similar habitat within 200 metres of known occurrences, ie. sandy ironstone soils or grey sands over ironstone, around winter wet areas near the coast (these provide potential habitat for natural range extension);
- remnant vegetation that surrounds or links several occurrences (this is to provide habitat for pollinators or to allow them to move between occurrences); and
- the local catchment for the surface and groundwaters that maintain the winter-wet habitat of the community (the plant community would be dependent on maintenance of the local hydrological conditions).

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

Given that this community is listed as threatened it is considered that all known habitat is habitat critical. In addition all occurrences are considered important to the survival of the ecological community. Recovery actions include survey for further occurrences that may lead to the identification of additional habitat critical.

1.8 Benefits to other species/ecological communities

Recovery actions implemented to improve the quality or security of the community are likely to improve the status of any species within the community. Declared Rare and Priority flora also occur within many occurrences and include *Lambertia orbifolia* subsp. Scott River Plains (Endangered under both the *Wildlife Conservation Act 1950* and the *Environment Protection and Biodiversity Conservation* (EPBC) *Act 1999*), *Darwinia ferricola* (Endangered under both the *Wildlife Conservation Act 1950* and the EPBC Act), *Dryandra nivea* subsp. *uliginosa* (Endangered under both the *Wildlife Conservation Act 1950* and the EPBC Act), *Grevillea brachystylis* subsp. *australis* (Endangered under the *Wildlife Conservation Act 1950*, Vulnerable under the EPBC Act), *Calothamnus* sp. Scott River (aff. *crassus*) (Priority 2), *Chordifex isomorphus* (Priority 4), *Loxocarya magna* (Priority 3), *Grevillea manglesioides* subsp. *ferricola* (Priority 2), *Hakea tuberculata* (Priority 3) and *Melaleuca incana* subsp. Gingilup (Priority 2) (Gibson *et al*. 2000). Recovery actions implemented to improve the quality or security of TEC, are likely to also benefit the rare and priority flora populations.

1.9 International Obligations

This plan is fully consistent with the aims and recommendations of the Convention on Biological

Diversity, ratified by Australia in June 1993, and will assist in implementing Australia's responsibilities under that Convention. However, as Scott River Ironstone association is not specifically listed under any international agreement, the implementation of other international environmental responsibilities is not affected by this plan.

1.10 Role and interests of indigenous people

According to the Department of Indigenous Affairs Aboriginal Heritage Sites Register and an investigation into the Aboriginal significance of wetlands and rivers in the Busselton-Walpole Region (O'Connor *et al*. 1995), there are a number of registered sites (engraving at Dunnet's Farm; artefacts at Scott River Trench, Brennan Ford/Scott River) known from the vicinity of occurrences of the Scott Ironstone community. Indigenous communities interested or involved in the region affected by this plan have not yet been identified, however, implementation of recovery actions under this plan includes consideration of the role and interests of indigenous communities in the region.

1.11 Social and economic impacts

The implementation of this recovery plan has the potential to have some social and economic impact as some occurrences are located on private property and other lands not managed specifically for conservation. 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. There are mineral exploration and extraction leases over of the area of land containing most occurrences of the TEC. Recovery actions refer to continued liaison between stakeholders with regard to these areas.

1.12 Evaluation of the Plans Performance

CALM, in conjunction with the South West Region 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 / recovery actions will be documented accordingly.

1.13 Historical and current threatening processes

Acid sulphate soils

Mineral exploration and extraction leases exist over the area of land in which most occurrences of the Scott River ironstone community occurs. However, the Scott River area has been identified as a particular area of concern for acid sulphate soils. Acid sulphate soil is a naturally occurring soil or sediment that contains iron sulfides that occur over extensive low lying areas under waterlogged or anaerobic conditions. Projects such as mineral sands mining that require excavations in areas where these soils are present, lowering the water table or compacting saturated soils or sediments resulting in groundwater extrusion and aeration of soils, may result in soil, groundwater and/or surface water acidity and the release of metals and precipitates. When exposed to air, oxidation takes place and when the soils capacity to neutralise the acidity is exceeded, sulfuric acid is produced (Appleyard *et al*. 2003). Any proposals to mine will be required to be referred to the Department of Environment.

In addition to excavation, drainage or dewatering can also lead to the generation of substantial amounts of sulfuric acid (URS 2003). The Water Corporation project entitled 'the South West Yarragadee Blackwood Groundwater Area Project' proposes to abstract 45 GL per year from the southern flowing portion of the Yarragadee aquifer (URS 2003). The eastern part of the Scott Coastal Plain, where the superficial aquifer is in direct connection with the Yarragadee aquifer, is potentially threatened by acidification as a consequence of this planned abstraction (URS 2003).

Clearing

The Scott River Plain has recently been extensively cleared for agriculture, although large areas of remnant vegetation still remain. Most of the remaining occurrences are on private property and not in secure conservation reserves (Gibson *et al*. 2000). Since being mapped in 1993, a number of occurrences (numbers 25, 26, 31, 35, 36 and 37) consisting of 45.5 hectares, of the Scott Ironstone community have been cleared. These occurrences were cleared for mining and agriculture and have not regenerated.

The presence of TECs is considered by the Department of Environment when evaluating the impact of any proposed development. As a result of recent amendments to the *Environmental Protection Act 1986*, any clearing of native vegetation requires a permit, unless done for an exempt purpose. Threatened ecological communities have been defined under the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*, as environmentally sensitive areas. Provisions in these regulations that allow day-to-day routine vegetation clearing activities without a permit do not therefore apply to clearing within threatened communities. Any clearing proposals in a TEC are to be undertaken under a specific permit.

Disease

A number of plant taxa that occur in the community, particularly members of the families Proteaceae and Epacridaceae, are very susceptible to dieback caused by *Phytophthora* species. Most occurrences are thought to be infected with the disease. After a number of deaths of species at occurrences 23 and 24, testing confirmed the presence of the disease. Dieback has the potential to seriously impact the community and, indeed, species diversity, through loss of remaining populations of some taxa. In particular, areas which contain low scrub on very shallow, often inundated soils over ironstone are considered to be extremely favourable for the spread of the disease (Obbens and Coates 1997). As yet no sites have been sprayed with phosphite to control the disease.

Risk of amplification or introduction of disease should be minimised by ensuring good hygiene procedures in all occurrences. This would involve washdown of any equipment used adjacent to the community, and restricting access by vehicles and machinery to dry soil conditions.

Road, track and firebreak maintenance

Road, track and firebreak maintenance activities threaten the community. Threats include actions such as creation of new firebreaks, grading of road reserves, road widening, spraying of chemicals, constructing drainage channels and mowing the roadside vegetation to improve visibility and reduce the fire risk. These disturbance events often encourage weed invasion into the adjacent habitat, as well as causing damage to vegetation, and may spread dieback.

The Shire of Augusta – Margaret River and other relevant authorities, such as Western Power, are to be officially informed of the location of the occurrences so that appropriate protective measures can be implemented. Landowners will also be informed of the presence of the community to prevent possible damage due to grazing, crop maintenance, firebreak maintenance or other activities that may threaten the populations.

Weed invasion

Although current weed levels in most occurrences are still quite low, all of the occurrences of this community are close to agricultural areas that act as weed sources, and would be vulnerable to weed invasion following any disturbance. 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.

There are tracks through some occurrences of the community. Weeds have invaded to varying extents along these tracks and such areas should be considered a high priority for weed control.

A weed control program would be necessary to maintain or improve the current condition of occurrences of the community in the long term. Panetta and Hopkins (1991) state that the aims of weed control are to maintain the pre-invasion condition of the habitat (prevention); control or arrest ongoing weed invasion (intervention); and reverse the degraded condition of the habitat where applicable (rehabilitation). A weed control program would involve the following steps (adapted from Panetta and Hopkins 1991):

1. Accurately mapping the boundaries of weed populations.
2. Selecting an appropriate herbicide or other method of weed control after determining which weeds are present.
3. Controlling weeds that pose the greatest threat to the community in the early stages of invasion where possible, eg invasive perennial grasses, *Watsonia*.
4. Rehabilitation through reintroduction of local native species where areas are no longer capable of regenerating following weed control.

Grazing and trampling

The Scott River Plain has been cleared extensively for stock grazing, despite the ironstone flats having poor drainage, and hence providing poor grazing (Tille and Lantzke 1990a). Grazing of the community is likely to have caused alterations to the species composition, by the selective grazing of edible species, the introduction of weeds and nutrients, trampling, and general disturbance. Most occurrences on private land are currently being degraded by grazing, or have been grazed historically, and in some instances (Occurrence 2) only larger shrubs and trees remain. A number of occurrences along Governor Broome Road are also being impacted by stock being moved along the road reserves. The significance of this impact in these occurrences is not known.

Kangaroos are also a threat to a number of occurrences, particularly 23, 24 and 39. Most occurrences are surrounded by cleared paddocks and therefore the kangaroos impact greatly on the vegetation through grazing, trampling and breaking foliage when moving through the area. Grazing would also have an impact on the establishment of young plants thereby limiting natural recruitment.

Altered fire regimes

Fires are likely to have a significant effect on the vegetation composition in Mediterranean ecosystems such as those in the south-west of Western Australia (Abbott and Burrows 2003).

Different ecosystems may require particular fire regimes to assist regeneration. There are few data available with which to elucidate which fire regimes enhance/protect the composition of the Scott Ironstone Association, so what actually constitutes an appropriate fire regime requires investigation. It seems likely that fire regimes such as long periods of fire exclusion and sustained frequent burns, and factors such as post-fire grazing (eg by rabbits), will be detrimental to the community.

Many of the taxa, in particular Declared Rare and Priority flora, that occur in this community are obligate seeders. Therefore, fires will need to occur at appropriate intervals and possibly at the appropriate season and intensity to maintain the composition and structure of this plant community.

The risk of fire is generally increased by the presence of grassy weeds in the understorey, as they are likely to be more flammable than many of the original native species in the herb layer.

A number of occurrences, in particular those along road reserves, have been frequently burnt. Too frequent fires cause increased weed invasion, especially in smaller remnants such as those along roads. Fire response plans have been formulated for the occurrences 23 and 24; Camping Reserve A12591 (occurrences 39, 3, 12, 13); and Gingilup Nature Reserve (Occurrence 1).

Changes to water levels

A number of the occurrences are located on the boundary of areas that are highly, if not completely, cleared for agriculture. Surface flow and groundwater recharge may be increased further in these areas if additional parts of the catchment are cleared. However as the ironstone community is likely to be dependent upon local superficial ground water above the south west Yarragadee aquifer, there is the potential for use of the deeper aquifer to result in greater downward leakage of superficial water causing eventual decline in water levels under the community. Water levels near major production bores to supply irrigated agriculture in the area in the western part of the Scott Coastal Plain have decreased by 0.5 to 2m in 10 years. Water levels in bores on the eastern part of the plain are stable (Department of Environment 2003).

Altered periods of ponding may effect the timing of growth of herbs in the understorey, and may also affect the species composition of the community by favouring different taxa.

Changes to nutrient status

Surface water in occurrences adjacent to farm lands may be polluted by animal droppings and artificial fertilisers. This is likely to favour weeds as they are adapted to higher levels of nutrients than native species. Recent studies have indicated that nutrient concentrations in water samples from the Scott River area may often exceed Australian and New Zealand Environment Conservation Council (ANZECC) guideline levels for ecosystem protection. Despite this the Scott River shows only few and occasional physical symptoms of eutrophication. This could be due to the dark colour of the water which is caused by a high level of tannin, which limits light penetration and plant growth (Department of Agriculture 2001).

Salinisation

Hydrological changes such as increased groundwater levels, depth or period of inundation may also cause salt accumulation near the ground surface. The Scott River area has been identified in the Australian Dryland Salinity Assessment 2000 as an area being at the highest risk from dryland salinity based on groundwater depth and soil system (National Land and Water Resources Audit 2001).

Tille and Lantzke (1990a) found that there have been some indications of salinity in a few areas on the Scott River Plain but it is not known whether these are isolated incidences or if salinity may become a widespread problem.

The levels of salinity in the community will need to be monitored to determine the level of threat posed by salinisation, and the major sources of the problem determined. Remedial actions such as replanting with deep rooted vegetation in strategic parts of the catchment may be necessary if monitoring indicates salinisation is a significant problem.

1.14 Guide For Decision-Makers

Section 1.13 above provides details of current and possible future threats. Proposed developments in the region of the Scott River Ironstone association require assessment. No developments should be approved unless the proponent can demonstrate that they will have no significant impact on the ironstone community and its hydrology. Impacts on the surface or groundwaters, leading to either changes in water quality or levels, would be expected to have a significant impact on the threatened ecological community.

1.15 Conservation status

The Scott Ironstone community meets the following criteria for Endangered (EN) ecological communities (English and Blyth 1997b):

B) Current distribution is limited, **and**:

i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and

the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the short term future (within approximately 20 years);

iii) there may be many occurrences but total area is small and all or most occurrences are small and/or isolated and very vulnerable to known threatening processes.

1.16 Strategies for recovery

To identify, and influence the management of, the areas in which the community occurs, so maintaining natural biological and non-biological attributes of the sites and the current area covered by the community.

To conduct appropriate research into the ecological characteristics of the community to develop further understanding about the management actions required to maintain or improve its condition.

2. RECOVERY OBJECTIVE AND CRITERIA

IRP Objective(s): To maintain or improve the overall condition of the Scott Ironstone plant community in the known locations and reduce the level of threat.

Criteria for success:
- An increase in the area of this community under conservation management.
- Maintenance in terms of diversity and basic composition of native species (as described in Gibson *et al*. 2000) as well as hydrological and biological processes, taking account of natural change of the community over time, as indicated by monitoring.
- Improvement in terms of reduction of numbers of, and area covered by exotic species and of other threatening processes as defined in this document, as indicated by monitoring.

Criteria for failure:
- Significant loss of area or further modification of occurrences of the threatened ecological community.

3. RECOVERY ACTIONS

Note: The responsible authority is frequently listed as the relevant CALM District. This refers largely to initiating and guiding actions. However, in general the relevant CALM District, the Species & communities Branch (SCB) and the Recovery Team share the primary responsibility for securing funds for recovery actions.

3.1 Coordinate recovery actions

The South West Region Threatened Flora and Communities Recovery Team (SWRTFCRT) will continue to coordinate recovery actions for the Scott River ironstone community and other Declared Rare Flora and Threatened Ecological Communities in their region. They will include information on progress in their annual reports to CALM's Corporate Executive and funding bodies.

Responsibility: CALM (Blackwood District) through the SWRTFCRT
Cost: $2,100 per year (to run team)
Completion date: Ongoing

3.2 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 occurrences are located, then critical habitat will also be determined and mapped for these locations ('first stage mapping').

CALM will seek to ensure that proponents of any development that have the potential to impact on this community undertake investigations to compare the conservation significance of occurrences of the community ('second stage mapping'). All occurrences are currently considered as 'critical habitat' for the Scott Ironstone Association but it is possible that some occurrences are so highly degraded as to be considered 'totally destroyed', or that some have been mostly cleared and are now very small in extent and may be no longer considered viable in the long-term.

Responsibility: CALM (Blackwood District, SCB) through the SWRTFCRT for first stage mapping; Proponents of developments, through CALM (Blackwood District) and the SWRTFCRT for second stage mapping.
Cost: $2,000 in first year for first stage mapping. Cost of second stage mapping to be determined.
Completion date: Year 1

3.3 Liaise with relevant land managers and other groups

Some of the occurrences of the community are managed by authorities other than CALM, or are privately owned. The involvement of land managers, local landholders, local government agencies, other government departments (such as Western Power) and industry in management of the community is therefore essential to the recovery process. In particular the Shire of Augusta – Margaret River's involvement in the recovery of the Scott River ironstone association will be greatly encouraged. Input and involvement will also be sought from any Aboriginal groups that have an active interest in areas of the Scott River Ironstone community.

Mining companies also hold mining tenements over areas that contain the community and will be encouraged to become more involved in conservation of the community.

Proposed developments such as the Water Corporation's plan to abstract large quantities of water from the Yarragadee aquifer in the vicinity of the Scott Ironstone Association have the potential for major impacts to this community. CALM will seek to ensure that any possible impacts are minimised through advice provided during environmental assessment and liaison and negotiation with relevant groups.

Responsibility: CALM (Blackwood District) through the SWRTFCRT
Cost: $2,500 per year for all liaison (not including vehicle costs)
Completion date: Ongoing

3.4 Survey and describe new ironstone occurrences

Areas of ironstone have been located along the Scott River, Adelaide and Snake springs, and near Black Point and Milyeanup Coast Road. It is not known if these areas are occurrences of the Scott Ironstone sub-communities as described in Gibson *et al*. (2000) or if they represent a new level of variation in the floristic composition in the Scott Ironstone Association. Plots will need to be installed (as per methods used in Gibson *et al*. 2000) and analysis undertaken to describe the community type. Additional occurrences will be entered onto the TEC database, including boundary information, condition and threatening processes.

Responsibility: CALM (Blackwood District; Science Division) through the SWRTFCRT
Cost: $6,200 per year
Completion date: Year 4

3.5 Monitor the extent and boundaries of occurrences

Occurrences will be monitored every two years. Boundaries can be determined from current aerial photographs and minimal on-site checking. Permission will be sought where occurrences occur on private property.

Accurate GPS mapping of community boundaries has commenced and a Geographic Information System database has been developed. Extent and boundary information will be added to the threatened ecological communities database as recommended in English and Blyth (1997b), as well as to the District's Geographic Information System database.

Responsibility: CALM (Blackwood District) through the SWRTFCRT
Cost: $2,000 every second year
Completion date: Ongoing

3.6 Disseminate information about the community

To prevent accidental destruction or damage to the community (for example, through powerline maintenance and stock movement) and gain public support for its conservation, information about the community will be provided to all managers of land that contains the community. This would include information from the threatened ecological communities database, and maps indicating the location of the community. Information about private land will only be disseminated more widely if permission is granted by the landholder.

CALM staff will ensure regular liaison with managers of land that contains the community to ensure threatened ecological community information is up to date.

A publicity campaign utilising local media and poster displays in prominent areas will be undertaken to encourage awareness about this threatened ecological community. An information sheet, which includes a description of the community, its habitat, threats, recovery actions and photos will be produced.

Responsibility: CALM (Blackwood District) through the SWRTFCRT
Cost: $2,000 in the first year; $600 per year thereafter
Completion date: Ongoing

3.7 Install markers

To reduce the likelihood of accidental destruction CALM will mark, or encourage the appropriate authorities to mark roadside occurrences of threatened ecological communities, and occurrences located on roads, tracks or firebreaks, with the same pegs as used to mark DRF. Pegs are already in place alongside some occurrences, as they mark the location of DRF. Where these pegs are located on the boundary of the community there is no need to put additional pegs in place, but additional pegs will be put in where the full extent of the community is not marked. These should be placed 50 m either side of the boundaries of the community to provide a protective buffer.

Responsibility: CALM (Blackwood District) through the SWRTFCRT
Cost: $600 in the first year
Completion date: Year 1

3.8 Design and implement a program for monitoring flora

A monitoring program will be established for a representative subset of the Scott Ironstone association that covers a range of 'sub-communities' (identified in Gibson *et al*. 2000) and management practices (eg road reserve, Nature Reserve). The line intercept method, that involves recording species present at set intervals along transects, will be used. Permanent plots already in place from the Gibson *et al*. (2000) survey may be used, wherever feasible.

A subset of occurrences will be monitored every three years or following a disturbance event, such as fire, to provide information on condition. Data collected will be entered onto a database and then analysed. Results will also be added to the threatened ecological communities database as recommended

in English and Blyth (1997a). This information is essential for determining changes in the community over time and the effects of significant events (eg too frequent fire).

Responsibility: CALM (Blackwood District) through the SWRTFCRT
Cost: $18,750 in year one ($3,750 per site x 5 sites); $12,500 in fourth year.
Completion date: Ongoing

3.9 Confirm the presence of dieback disease, and monitor

The presence of dieback disease will be confirmed through mapping and collection and testing of suspected soil and plant samples. Priority areas for dieback treatment in the community will be determined using CALM's Dieback Management Guidelines (CALM 1999).

Dieback fronts within, or very close to, the community will be mapped accurately using differential GPS, and a photo monitoring point set up. The dieback front will be monitored at least every two years in summer.

Responsibility: CALM (Blackwood District) through the SWRTFCRT
Cost: $3,000 every second year
Completion date: Ongoing

3.10 Implement dieback treatment, if required

The results of Action 3.9 will be used to assign priorities for any phosphite spraying that may be required. High priority areas are likely to include sites that are identified as being highly susceptible to the disease, and are at high risk of becoming infected, and areas that are already infected and at risk of suffering high level impacts from the disease. Data on future biodiversity implications, such as the loss or decline of DRF or Priority taxa, or structurally or functionally important taxa, are also likely to be important determinants of the priority of treatment for individual occurrences. CALM will then implement the treatments recommended in the current Dieback Management Guidelines (CALM 1999) for infected areas, commencing with the highest priority sites.

Such a strategy should initially be implemented in the community on CALM lands, then, with the cooperation of landholders, extended to occurrences on private lands. The protocol will incorporate results of monitoring from current and future methods of experimental dieback treatments.

Experimental dieback management using a crop dusting aircraft to spread phosphite is being undertaken on occurrences of the Shrublands on southern Swan Coastal Plain Ironstones (Busselton area) community (community type 10b as described in Gibson *et al*. 1994). This ironstone community was sprayed with 20% phosphite at a rate of 30 litres per hectare and another section containing mostly *Banksia attenuata* community sprayed at a rate of 60 litres per hectare. The whole area was then sprayed with 10% phosphite at 60 litres per hectare (English 1999). Aerial applications may provide protection for up to 3 years (CALM 1999). Dieback caused by *Phytophthora* species has been confirmed at occurrences 23 and 24 of the Scott Ironstone association.

Responsibility: CALM (Blackwood District; Dieback Coordinating Group) through the SWRTFCRT
Cost: $27,200 every two years
Completion date: Ongoing

3.11 Prevent the further spread of dieback

The ironstone habitat is inundated over the winter months, and this favours the establishment and spread of *Phytophthora* species. Many plant species in the ironstone community are presumed to be susceptible to this disease. Dieback hygiene (outlined in CALM 2003) will therefore be adhered to for activities such as installation and maintenance of firebreaks and walking into the population in wet soil conditions. This

would involve washdown of any equipment used adjacent to the community, and restricting access by vehicles and machinery to dry soil conditions.

Responsibility: CALM (Blackwood District) through the SWRTFCRT
Cost: $400 per year; costs of all liaison included in 3.3
Completion date: Ongoing

3.12 Develop and implement a Fire Management Strategy

A fire management strategy will be developed and implemented that encompasses the following (3.12.1-3.12.4) and includes an annual fire monitoring and reporting schedule.

There is a need for research into recovery of the community from fire (to be completed under Action 3.8 flora monitoring), and to determine the implications of findings for management. This would also include producing a fire history map of the occurrences, which is updated annually. As little is known of the response of the community to fire, no planned burns should be implemented for the life of this IRP, unless results of future studies suggest that it is necessary and urgent. A Fire Management Strategy will include recommendations on fire frequency, intensity, season, and control measures. Fire response plans have been developed for occurrences 1, 3, 12, 13, 23, 24 and 39 but will be developed for all occurrences of this community, using the existing plans as a guide. These will then be incorporated into the Fire Management Strategy.

Close liaison will be required between all stakeholders to develop a Fire Management Strategy.

Responsibility: CALM (Blackwood District) through the SWRTFCRT; in consultation with all stakeholders
Cost: $3,000 for preparation of strategy
Completion date: Year 1, implementation ongoing

3.12.1 Maintain strategic firebreaks

Maintenance of existing firebreaks is appropriate where firebreaks are already constructed, unless maintenance is likely to cause spread or intensification of dieback or otherwise degrade the community. Where firebreaks are not deemed strategically necessary, they will be closed and allowed to rehabilitate. Careful use of herbicides would be the preferred method of maintenance of firebreaks to minimise soil movement and risk of dieback spread or intensification in the community. No new firebreaks will be constructed on occurrences.

Local CALM staff will ideally be involved in planning firebreak construction and maintenance for all occurrences of the community.

Responsibility: CALM (Blackwood District) through the SWRTFCRT in liaison with surrounding landholders
Cost: Cost of firebreaks $2,500 per year; costs of liaison included in 3.3
Completion date: Ongoing

3.12.2 Liaise with surrounding landholders to ensure strategies for fuel reduction on their lands do not impact the community

For example, burning at inappropriate times when fires are likely to spread to adjacent lands should be avoided.

Responsibility: CALM (Blackwood District) through the SWRTFCRT in liaison with surrounding landholders
Cost: Costs of liaison included in 3.3
Completion date: Ongoing

3.12.3 Ensure fire suppression actions do not impact the community

Fire fighting authorities will be informed of the importance of not constructing new tracks during their operations, including during wildfires. The use of heavy machinery to create new firebreaks within the community should be avoided because additional disturbance would encourage further weed invasion and dieback spread, and chemicals that may be toxic to the community should not be used. Guidelines for appropriate fire suppression actions should be developed as part of 3.12.1.

A local CALM staff member will ideally be present during wildfires and controlled burns in remnants that contain occurrences of the community, to advise on protecting the conservation values of the community.

Responsibility: CALM (Blackwood District) through the SWRTFCRT in liaison with local Bush Fire Brigades and Fire and Rescue Service
Cost: Costs of preparation of guidelines and liaison included in 3.12.1 plus additional funds for District staff to attend fires in the community - $1,000 per year
Completion date: Ongoing

3.13 Monitor water quality and levels

CALM will seek to have a monitoring program established that is designed to provide detailed information about the groundwater regime of the Scott Ironstone Association. Given current levels of water abstraction in the Scott River Plains, abstraction may already be impacting the community to some extent. Advice will be sought from relevant experts in DoE and other appropriate organisations with regard to the infrastructure and other resources required for measuring groundwater depths and quality in and adjacent to the community. Long-term monitoring of a network of bores that allow measurement of water at different depths in suitable locations to will help to determine the likely impacts of any future developments that have the potential to cause further drawdown of major aquifers, or to alter water quality in the vicinity of the community.

The Scott River area has been identified as an area being at the highest risk from dryland salinity based on groundwater depth and soil system (National Land and Water Resources Audit (2001). Monitoring salinity and ponding in a number of northern and southern occurrences will indicate whether remedial action is necessary in the catchment. This may include the need for strategic planting of deep-rooted vegetation to increase water usage.

Salinity of surface waters should be monitored in liaison with Agriculture Western Australia, the local Land Conservation District Committee (LCDC) and Department of Environment (DoE). The depth and timing of inundation will be measured by checking against a depth gauge at specific intervals (say weekly during winter, and monthly thereafter).

Responsibility: CALM (Blackwood District) through the SWRTFCRT, in liaison with Agriculture Western Australia, Water Corporation, the LCDC and the DoE
Cost: Costs of liaison included in Action 3.3; $2,500 per year for monitoring of depths. Costs of bore network and other resources required for long-term groundwater monitoring to be determined.
Completion date: Ongoing

3.14 Monitor weeds

Floristic data from Gibson *et al.* (2000), Gibson *et al.* (2001) and Robinson and Keighery (1997) may help determine weeds that pose the greatest threat to some occurrences. Some significant weeds in occurrences may not occur in plots, however. Weed populations will be accurately mapped and appropriate herbicides or other method of weed control determined. Monitoring of weed levels can be included in Action 3.8.

Responsibility: CALM (Blackwood District) through the SWRTFCRT
Cost: $4,000 every second year to monitor boundaries of weed populations that pose the greatest threat to the community
Completion date: Ongoing

3.15 Implement weed control, and rehabilitate where necessary

The highest priority will be to control weeds that pose the greatest threat to the community, in the early stages of invasion where possible, eg invasive perennial grasses and *Watsonia*. Appropriate methods of weed control are found in Brown and Brooks (2002) and may include hand weeding or localised application of herbicide.

The herb layer is an integral part of this plant community and care will be taken to minimise disturbance of native herbs in any weed control program.

Where sites are severely degraded and are unlikely to regenerate naturally, areas will be replanted with seed or seedlings sourced from local native taxa that occur in the community.

Responsibility: CALM (Blackwood District) through the SWRTFCRT
Cost: $3,000 per year
Completion date: Ongoing

3.16 Develop strategy for ex-situ propagation

Occurrences cleared historically could be utilised as seed orchards for DRF that occur in the community such as *Lambertia orbifolia* subsp. Scott River Plains, *Darwinia ferricola* ms and *Dryandra nivea* subsp. *uliginosa*. Such a translocation was initiated by BHP Billiton in 2003 in conjunction with Botanic Garden and Parks Authority (BGPA) at a previously cleared area of ironstone.

Seed from individual occurrences only should be used to establish seed orchards, and then seed reintroduced into the original sites.

A strategy for use of degraded areas of the ironstone community for ex-situ propagation of endangered ironstone taxa will continue to be developed and implemented.

Responsibility: CALM (Blackwood District; Science Division; Threatened Flora Seed Centre (TFSC)); BGPA through the SWRTFCRT
Cost: $15,000 in years one, two and three to grow plants
Completion date: Ongoing

3.17 Design and conduct research

Research will be designed to increase the understanding of characteristics of the community to assist future management decisions. Such research will include:

1. The hydrogeology of occurrences of the community.
2. The impact of weeds on the community.
3. The role of disturbance in regeneration of the community.
4. The recovery of the community following recent fires (this will be considered in the fire management strategy developed under 3.12).
5. The development of a monitoring system. Protocols will be developed as part of future guidelines for monitoring threatened ecological communities based on recommendations in English and Blyth (1997a).
6. Biological processes in the community, eg pollination biology, germination requirements, longevity and time taken to reach maturity of significant plant taxa in the community.

Responsibility: CALM (Blackwood District; Science Division) through the SWRTFCRT
Cost: Recovery Team to determine costs and likely funds available through possible sources and to recommend a research program and sources of funds to CALM
Completion date: Ongoing

3.18 Report on success of management strategies for the community

Reporting on the success of overall strategies to maintain or improve condition of the Scott Ironstone community will be done in annual reports prepared by the Recovery Team for CALM's Corporate Executive. A final report will be prepared at the end of five years, possibly as part of the preparation of a full Recovery Plan (see 3.19 below).

Responsibility: CALM (Blackwood District); through the SWRTFCRT
Cost: $2,000 per year
Completion date: Year 5

3.19 Review the need for a full Recovery Plan

At the end of the fourth year of its five-year term this Interim Recovery Plan will be reviewed and the need for further recovery actions will be assessed. If the community is still ranked as Endangered at that time a full Recovery Plan may be required.

Responsibility: CALM (Blackwood District and SCB) through the SWRTFCRT
Cost: $17,500 in Year 5 (if full Recovery Plan required).
Completion date: Year 5

SPECIFIC MANAGEMENT ACTIONS; SECTIONS OF OCCURRENCES 1-5, 11-22, 33, 34, 39 ON PUBLIC LANDS

3.20 Seek to improve conservation status of areas on public land

If conservation management of areas on public land that contain the community (a portion of Chester Forest block (Occurrence 5) Unallocated Crown Land (part Occurrence 2), Camping Reserve A12951 (part occurrences 3, 12, 13), Governor Broome Rd road reserve (Occurrences 11, 13 14-22), Scott River Rd road reserve (Occurrences 33-34) and Dennis Rd road reserve (Occurrences 4 and 5)) seems unlikely to result from actions in this IRP, CALM will seek to have the occurrences and adequate buffer areas declared as Class A reserves for the purpose of 'Conservation of Flora and Fauna' placed under the care, control and management of the Conservation Commission. In addition, amendment of the status of Gingilup Nature Reserve 30626 (Occurrence 1), Scott River Banks Nature Reserve C42942 (Occurrence 3) and Nature Reserve 42377 (Occurrence 39) from C Class to A Class will be sought.

Responsibility: CALM (Blackwood District; Land Acquisitions Section), DOLA through the SWRTFCRT
Cost: Costs of liaison included as part of 3.3
Completion date: Not known

3.21 Develop a management plan for the community on road reserves

If acquisition of the road reserves listed under Action 3.20 is not successful, CALM will negotiate with the Shire to have the areas declared as 'Flora Roads' and to have their importance for conservation indicated through signage. Should the development of 'Flora Roads' also not be possible, the cooperative preparation of a management plan that would guide conservation of the threatened ecological community on the road reserves on Governor Broome, Dennis and Scott River Roads will be sought.

Responsibility: CALM (Blackwood District) through the SWRTFCRT, in liaison with land managers
Cost: Costs of liaison included as part of 3.3; cost of plan preparation $10,000
Completion date: Year 2

3.22 Fence occurrences on road reserves as necessary

On the basis of the results of Action 3.5, the requirement for fences will be determined (eg to prevent grazing and trampling by stock). Fencing will be sought to protect occurrences, including suitable buffer areas as required.

Responsibility: CALM (Blackwood District) through the SWRTFCRT, in liaison with landholders
Cost: Costs of liaison included in 3.3; fencing costs to be determined
Completion date: Year 2

SPECIFIC MANAGEMENT ACTIONS - OCCURRENCES 2, 6-12, 20, 21, 23, 24, 27-30, 32 and 38 ON PRIVATE LANDS.

3.23 Seek to fence occurrences on private land where appropriate

On the basis of the results of Action 3.5, the requirement for fences will be determined (eg to prevent grazing by stock or inappropriate vehicle access). CALM staff will negotiate to have these occurrences fenced, including suitable buffer areas as required. Part of Occurrence 11 has been identified as a site where fencing is desirable.

Responsibility: CALM (Blackwood District) through the SWRTFCRT, in liaison with landholders
Cost: Costs of liaison included in 3.3; fencing costs to be determined
Completion date: Year 2

3.24 Encourage and assist landowners to access available incentives and mechanisms for conserving the ironstone community

Incentives for protection include CALM's Land for Wildlife Scheme and funds that may be available through various grants to ensure long term protection of the community. CALM staff will seek to assist land managers to access various incentives for conservation.

Responsibility: CALM (Blackwood District) through the SWRTFCRT, in liaison with landholders
Cost: Costs of liaison included in 3.3
Completion date: Ongoing

3.25 Seek to acquire occurrences if the community is not being successfully managed for conservation, or if they become available

If management for conservation seems unlikely to result from actions in this IRP, or if private land that contains occurrences of the community in good condition becomes available, CALM will seek funds and negotiate to acquire occurrences and adequate buffer areas. These areas will then be proposed as Class A reserves for the purpose of 'Conservation of Flora and Fauna' with their care, control and management vested with the Conservation Commission.

The highest priority for acquisition are the largest areas in good condition on private land. Occurrence 11 is considered to be a high priority for acquisition.

Responsibility: CALM (Blackwood District; Land Acquisitions Section), through the SWRTFCRT, in liaison with landholders
Cost: Market price of land at time of purchase
Completion date: Ongoing

Table 3: Summary of recovery actions

Recovery Action	Occurrences	Responsibility	Completion date
Coordinate recovery actions	All	CALM (Blackwood District)	Ongoing
Map critical habitat	All	CALM (Blackwood District, SCB)	Year 1
Liaise with relevant land managers	All	CALM (Blackwood District)	Ongoing
Survey and describe new occurrences	All	CALM (Blackwood District, Science Division)	Year 4
Monitor extent and boundaries	All	CALM (Blackwood District, Science Division, SCB)	Ongoing
Disseminate information	All	CALM (Blackwood District)	Ongoing
Install markers	All	CALM (Blackwood District)	Year 1
Design and implement program for monitoring flora	5 sites	CALM (Blackwood District)	Ongoing
Confirm dieback and monitor	All	CALM (Blackwood District)	Ongoing
Implement dieback treatments	4, 5, 23, 24	CALM (Blackwood District, Dieback Coordinating Group)	Ongoing
Prevent the further spread of dieback	All	CALM (Blackwood District)	Ongoing
Develop and implement a Fire Management Strategy	All	CALM (Blackwood District) in consultation with all stakeholders	Ongoing
Monitor water quality and levels	Examples of northern and southern group of occurrences	CALM (Blackwood District), liaison with WRC, LCDCs and Agriculture Western Australia	Ongoing
Monitor weeds	All	CALM (Blackwood District)	Ongoing
Implement weed control	All	CALM (Blackwood District)	Ongoing
Develop strategy for ex-situ propagation	those which contain DRF	CALM (Blackwood District)	Ongoing
Design and conduct research	All	CALM (Blackwood District, Science Division)	Ongoing
Report on success of management strategies for the community	All	CALM (Blackwood District)	Year 5
Review the need for a full Recovery Plan	All	CALM (Blackwood District, SCB)	Year 5 (if required)
Seek to improve conservation status of public land occurrences	1-5, 11-13, 14-22, 33-34, 39	CALM (Land Acquisitions Section, Blackwood District), DOLA	Ongoing
Develop management plan for occurrences on roads	4, 5, 11, 13-22, 33, 34	CALM (Blackwood District), management bodies	Year 2
Fence road occurrences	4, 5, 11, 13-22, 33, 34	CALM (Blackwood District), land managers	Year 2
Fence occurrences on private land	2, 6-12, 20, 21, 23, 24, 27-30, 32, 38	CALM (Blackwood District), landholders	Year 2
Access funding incentives for conservation	2, 6-12, 20, 21, 23, 24, 27-30, 32, 38	CALM (Blackwood District), landholders	Ongoing
Seek to acquire community on private land	11, 23, 24 (highest priorities)	CALM (Blackwood District, Land Acquisitions Section), Environment Australia	When required or as available

Table 4: Summary of costs for each recovery action

Recovery Action	Year 1	Year 2	Year 3	Year 4	Year 5
Coordinate recovery actions	$2,100	$2,100	$2,100	$2,100	$2,100
Map critical habitat First stage	$2,000				
Second stage	To be determined				
Liaise with land managers	$2,500	$2,500	$2,500	$2,500	$2,500
Survey and describe new occurrences	$6,200	$6,200	$6,200	$6,200	$6,200
Monitor the extent and boundaries of occurrences	$2,000		$2,000		$2,000
Disseminate information	$2,000	$600	$600	$600	$600
Install markers	$600				
Design and implement program for monitoring flora	$18,750			$12,500	
Confirm dieback disease and monitor	$3,000		$3,000		$3,000
Implement dieback treatment	$27,200		$27,200		$27,200
Prevent the further spread of dieback	$400	$400	$400	$400	$400
Develop Fire Management Strategy	$3,000				
Maintain firebreaks	$2,500	$2,500	$2,500	$2,500	$2,500
Liaise on fire management					
Ensure fire suppression actions do not impact the community	$1,000	$1,000	$1,000	$1,000	$1,000
Monitor water quality and levels	$2,500 Costs of bore network - to be determined	$2,500	$2,500	$2,500	$2,500
Monitor weeds	$4,000		$4,000		$4,000
Implement weed control	$3,000	$3,000	$3,000	$3,000	$3,000
Develop strategy for ex-situ propagation	$15,000	$15,000	$15,000		
Design and conduct research	To be determined				
Report on management strategies	$2,000	$2,000	$2,000	$2,000	$2,000
Review the need for a full Recovery Plan					$17,500 (if required)
Seek to improve conservation status of areas on public land					
Develop management plan for community on road reserves		$10,000 (if deemed necessary)			
Fence occurrences on road reserves		To be determined			
Fence occurrences on private land		To be determined			
Assist landholders to access funds for conservation					
Seek to acquire occurrences on private land	To be determined				

Summary of costs over five years

Year 1	**$99,750**
Year 2	**$47,800**
Year 3	**$74,000**
Year 4	**$35,300**
Year 5	**$76,500**
Total	**$333,350**

4. TERM OF PLAN

This Interim Recovery Plan will operate from September 2004 to August 2009 but will remain in force until withdrawn or replaced. After five years, the need to review this IRP or to replace it with a full Recovery Plan will be determined.

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APPENDIX 1

Adaptation of sorted two way table from Gibson *et al*. (2000) showing species occurrence by community type within the Scott River Ironstone. Only taxa which occurred in at least two sites were included.

Taxon	**Community Type**				
	4	5	6	8	9
Species Group A					
Acacia extensa	*				
Darwinia oederoides	*				
Philotheca spicata	*	*			
Xanthosia huegelii	*	*			
Austrodanthonia setacea	*				
Thysanotus tenellus	*				
Stylidium luteum subsp. *glaucifolium*	*				
Caesia micrantha	*			*	
Chamaescilla corymbosa	*				
Burchardia multiflora	*				
Homalosciadium homalocarpum	*		*		
Patersonia juncea	*				
Species Group B					
Acacia pulchella	*				
Aira caryphyllea	*				
Hyalosperma cotula	*			*	
Siloxerus humifusus	*			*	
Patersonia occidentalis	*	*		*	
Podolepis gracilis	*			*	
Briza minor	*			*	
Desmocladus fasciculatus	*			*	
Opercularia vaginata	*		*	*	
Xanthorrhoea preissii	*			*	
Aphelia cyperoides	*	*	*	*	
Centrolepis aristata	*			*	
Philydrella pygmaea	*			*	
Lepidosperma squamatum	*		*	*	
Schoenus odontocarpus	*				
Kunzea aff. *micrantha* (BJK&NG 40)	*			*	
Drosera glanduligera	*				
Hemiandra pungens	*		*		
Hypochaeris glabra	*	*	*		
Phyllangium paradoxum	*	*	*	*	
Cyperus tenellus	*			*	
Lepyrodia aff. *macra* (BJK&NG 1026)	*			*	
Tremulina tremula	*			*	
Loxocarya magna	*			*	
Pericalymma ellipticum	*	*		*	*
Stylidium ecorne	*			*	
Thelymitra flexuosa	*			*	
Viminaria juncea	*		*	*	
Drosera macrantha subp. m*acrantha*	*				
Stylidium perpusillum	*				
Hakea sp. (BJK&NG 226)	*				
Stylidium bulbiferum	*		*		
Species Group C					
Desmocladus flexuosus				*	

Taxon	Community Type				
	4	5	6	8	9
Goodenia eatoniana				*	
Dryandra nivea subsp. *uliginosa*				*	
Vulpia bromoides	*				
Stylidium repens	*				
Levenhookia pusilla	*				
Species Group D					
Astartea aff. *fascicularis*	*			*	
Juncus bufonius	*			*	
Cyathochaeta avenacea	*			*	*
Melaleuca preissiana	*				*
Meeboldina roycei ms	*				*
Melaleuca aff. *incana* (NG&ML 593)	*				*
Eriochilus dilatatus	*				
Lolium rigidum	*				
Lepidosperma longitudinale	*				
Melaleuca polygaloides	*				
Poa poiformis	*				
Grevillea manglesioides	*				*
Stylidium inundatum	*			*	
Hydrocotyle alata	*				
Tribonanthes australis	*				
Species Group E					
Centrolepis glabra	*				
Trithuria bibracteata	*				
Triglochin centrocarpum	*				
Monopsis debilis	*			*	
Thysanotus multiflorus	*				
Hypolaena fastigiata	*				
Juncus articulatus	*				
Lotus suaveolens	*				
Isolepis cyperoides	*				
Leucopogon carinatus	*				
Species Group F					
Agonis flexuosa	*		*		
Boronia spathulata			*		
Hakea tuberculata	*		*	*	
Kunzea recurva	*		*		
Sowerbaea laxiflora	*		*		
Ornithopus compressus			*		
Sonchus oleraceus			*		
Parentucellia viscosa	*		*		
Species Group G					
Amphipogon debilis	*			*	
Cassytha racemosa	*			*	
Isotoma hypocrateriformis	*				
Bartsia trixago	*				
Schoenus bifidus	*				
Stylidium mimeticum	*				
Thelymitra crinita	*				
Thysanotus manglesianus	*				

Taxon	Community Type				
	4	5	6	8	9
Austrostipa compressa	*				
Epilobium billardierianum	*				
Trichocline sp. (BJK&NG 564)	*				
Conostylis setigera	*				
Neurachne alopecuroidea	*				
Selaginella gracillima	*				
Stylidium crassifolium	*				
Species Group H					
Acacia myrtifolia	*			*	
Calothamnus aff. *crassus* (R.D.Royce 84)	*	*		*	
Velleia trinervis	*			*	
Boronia anceps				*	
Grevillea aff. *manglesioides* (GJK 15158)				*	
Stenotalis ramosissima	*			*	*
Adenanthos detmoldii				*	
Chordifex isomorphus	*			*	
Melaleuca incana				*	
Caesia occidentalis			*	*	
Mesomelaena tetragona	*		*	*	
Vellereophyton dealbatum	*		*	*	
Stylidium spathulatum	*	*		*	
Xanthorrhoea platyphylla				*	
Species Group I					
Eutaxia virgata	*			*	
Schoenus rigens				*	
Hakea ceratophylla				*	*
Schoenus asperocarpus				*	
Sphenotoma capitatum		*		*	
Villarsia parnassifolia	*			*	
Species Group J					
Actinodium cunninghamii		*			
Schoenus curvifolius		*			
Cytogonidium leptocarpoides		*			
Euchilopsis linearis		*			
Dasypogon bromeliifolius	*	*		*	
Darwinia ferricola ms		*		*	
Cassytha glabella	*	*			
Drosera pallida	*	*			
Dampiera linearis	*	*		*	
Baxteria australis	*	*			
Leucopogon pendulus	*				
Sphenotoma gracile	*				
Species Group K					
Conostylis aculeata	*				
Patersonia occidentalis (swamp form)				*	
Briza maxima	*	*	*	*	
Romulea rosea			*		
Haloragis tenuifolia	*				
Hypolaena pubescens	*			*	
Microtis media	*			*	

Taxon	**Community Type**				
	4	5	6	8	9
Species Group L					
Caladenia marginata	*				
Drosera menziesii subsp. *menziesii*	*				
Isolepis marginata	*				
Polypompholyx multifida	*				
Elythranthera brunonis	*				
Hakea sulcata	*			*	
Stylidium guttatum				*	
Hypolaena exsulca		*			
Lyginia barbata				*	
Species Group M					
Hakea varia	*			*	
Stylidium pulchellum		*		*	
Chamaescilla corymbosa var. *latifolia*				*	
Hibbertia stellaris	*			*	
Nuytsia floribunda				*	
Species Group N					
Centrolepis alepyroides				*	
Hydrocotyle callicarpa	*				
Vulpia myuros				*	
Centrolepis mutica	*				
Verticordia plumosa	*				
Cicendia filiformis	*				
Juncus capitatus	*				
Schoenus discifer	*				
Calothamnus lateralis	*				

GLOSSARY (Atkins 2003)

Declared Rare Flora (DRF): 'Taxa which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such.'

Priority 1 (P1): 'Taxa which are known from one or a few (generally <5) populations which are under threat, either due to small population size, or being on lands under immediate threat, e.g. road verges, urban areas, farmland, active mineral leases, etc., or the plants are under threat, e.g. from disease, grazing by feral animals, etc. May include taxa with threatened populations on protected lands. Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.'

Priority 2 (P2): 'Taxa which are known from one or a few (generally <5) populations, at least some of which are not believed to be under immediate threat (i.e. not currently endangered). Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.'

Priority 3 (P3): 'Taxa which are known from several populations, and the taxa are not believed to be under immediate threat (i.e. not currently endangered), either due to the number of known populations (generally <5), or known populations being large, and either widespread or protected. Such taxa are under consideration for declaration as 'rare flora' but are in need of further survey.'

Priority 4 (P4): 'Taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5-10 years.'