

INTERIM RECOVERY PLAN NO. 230

SHRUBLANDS AND WOODLANDS on the EASTERN side of the SWAN COASTAL PLAIN (COMMUNITY type 20C)

**INTERIM RECOVERY PLAN
2006-2011**



November 2006

Department of Environment and Conservation



FOREWORD

Interim Recovery Plans (IRPs) are developed within the framework laid down in Department of Conservation and Land Management (CALM, now Department of Conservation and Environment - DEC) 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.

DEC is committed to ensuring that Critically 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 DEC's Director of Nature Conservation.

This Interim Recovery Plan replaces plan number 58 – 'Eastern shrublands and woodlands (Swan Coastal Plain community 20c)', Interim Recovery Plan 2000-2003, by V. English and J. Blyth.

This Interim Recovery Plan will operate from November 2006 but will remain in force until withdrawn or replaced. It is intended that, if the ecological community is still ranked Critically Endangered, this IRP will be replaced by a full Recovery Plan after five years.

This IRP was given regional approval on 25 September 2006 and was approved by the Director of Nature Conservation on 1 November 2006. The allocation of staff time and provision of funds identified in this Interim Recovery Plan is dependent on budgetary and other constraints affecting DEC, as well as the need to address other priorities.

Information in this IRP was accurate at January 2006.

ACKNOWLEDGMENTS

This Interim Recovery Plan was prepared by Rachel Meissner, Val English and Jill Pryde.

The National Reserve System Program of Environment Australia (now Department of the Environment and Heritage) funded the project entitled 'Identifying and conserving threatened ecological communities in the south west botanical province'. The project confirmed the threatened status of this plant community.

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

*Fiona Felton, Mike Meinema and Alice Reaveley	DEC Perth Hills District (*previously)
Bronwen Keighery	DEC Terrestrial Ecosystems Branch
Neil Gibson and Greg Keighery	DEC, Science Division
Grant MacKinnon	City of Swan
Kate Brown and Renee Miles	DEC Urban Nature
Friends of Talbot Road Reserve	

Cover photograph by Jill Pryde.

CITATION

This Interim Recovery Plan should be cited as:

Department of Environment and Conservation (2006). Interim Recovery Plan 2006-2011 for the shrublands and woodlands of the eastern side of the Swan Coastal Plain (community type 20c). Interim Recovery Plan No. 230. Department of Environment and Conservation, Perth.

SUMMARY

Name: 'Shrublands and woodlands of the eastern side of the Swan Coastal Plain' (Swan Coastal Plain community type 20c).

Description: The community occurs mainly on the transitional soils of the Ridge Hill Shelf, on the Swan Coastal Plain adjacent to the Darling Scarp, but also extends marginally onto the alluvial clays deposited on the eastern fringe of the Swan Coastal Plain. The community occurs as a shrubland, or a woodland of *Banksia attenuata* and *Banksia menziesii*, sometimes with *Allocasuarina fraseriana*, over a shrub layer that can include the species *Adenanthos cygnorum*, *Hibbertia huegelii*, *Scaevola repens* var. *repens*, *Allocasuarina humilis*, *Bossiaea eriocarpa*, *Hibbertia hypericoides* and *Stirlingia latifolia*. A suite of herbs including *Conostylis aurea*, *Trachymene pilosa*, *Lomandra hermaphrodita*, *Burchardia umbellata* and *Patersonia occidentalis*, and the sedges *Mesomelaena pseudostygia* and *Lyginia barbata* usually occur in the community. The weeds *Gladiolus caryophyllaceus* and *Ursinia anthemoides* are also common.

DEC Region: Swan

DEC District: Perth Hills

Local Government Authority: City of Swan

Recovery Team: Swan Region Threatened Flora and Communities Recovery Team (SRFTFCRT). Membership: representatives from DEC's Swan Region (Chair), Swan Coastal District, Perth Hills District, Species and Communities Branch (SCB) and Science Division; and City of Gosnells, Botanic Gardens and Parks Authority (BGPA) and WWF Australia.

Current status: Assessed 18 July 1996 as Critically Endangered. Also listed as Endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (note: community name as listed under the EPBC Act is 'Shrublands and woodlands of the eastern Swan Coastal Plain').

Habitat requirements: The community occurs on the eastern side of the Swan Coastal Plain in the foothills of the Darling Scarp and reflects this transitional landform and soil zone between the Scarp and the Swan Coastal Plain. Many of the plant species present in the community are more common on the Scarp. The assemblage also contains species commonly associated with marri - wandoo woodlands on heavy soils.

Habitat critical to the survival and important occurrences: The habitat that is critical for survival of the 'shrublands and woodlands of the eastern side of the Swan Coastal Plain' community is the area of occupancy of known occurrences, areas of similar habitat within 200 metres of known occurrences, and remnant vegetation that surrounds or links several occurrences. Given that the community is listed as Critically Endangered, it is considered that all known occurrences of the community are critical to the survival of the community.

Benefits to other species/ecological communities: Two priority flora are found within Occurrence 1. These are *Isopogon drummondii* (P3) and *Thysanotus glaucus* (P4).

Other threatened ecological communities, which are described in Gibson *et al.* (1994), are found in bushland adjacent to occurrences of the 'shrublands and woodlands of the eastern side of the Swan Coastal Plain'. '*Eucalyptus calophylla* - *Xanthorrhoea preissii* woodlands and shrublands' ('community type 3c', listed as Critically Endangered in Western Australia, and as Endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*) occurs adjacent to the 'shrublands and woodlands of the eastern side of the Swan Coastal Plain' in Talbot Road Bushland (Occurrence 1). '*Banksia attenuata* woodlands over species rich dense shrublands' ('community type 20a', listed as Endangered in Western Australia) occurs close to Occurrence 2.

Recovery actions implemented to improve the habitat quality, or the security of the community are likely to improve the status of any species within the community, and of any other threatened ecological communities that occur close to the occurrences.

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 the 'shrublands and woodlands of the eastern side of the Swan Coastal Plain' 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: An Aboriginal Sites Register maintained by the Department of Indigenous Affairs lists a number of significant sites within the two confirmed occurrences, and within Stirling Crescent Bushland

where additional occurrences may exist. Blackadder Creek, which runs through Occurrence 1, is of special significance to indigenous communities as it is part of the Green Bullfrog Dreaming Track and home of the dreaming track of the Ancestors. Indigenous communities interested or involved in the region affected by this plan have been identified for Occurrence 1, and were involved in development of the management plan developed for the reserve that contains that occurrence (Talbot Road Bushland). The recommendations held in this plan are consistent with those held in that management plan. In addition, preliminary discussions have been held with indigenous people who have cultural links to the creekline that runs through Occurrence 1, with regard to future management of the creek. Occurrence 2 is on land under the care, control and management of the Commonwealth Government, and there are currently no active negotiations to transfer that land to another authority. The existence of other occurrences of the 'shrublands and woodlands of the eastern side of the Swan Coastal Plain' in other areas (that is, within Stirling Crescent Bushland) will require further investigation. Implementation of recovery actions under this plan includes consideration of the role and interests of indigenous communities.

Social and economic impacts: Part of Occurrence 1 occurs on land managed by the Metropolitan Cemeteries Board and the presence of this threatened ecological community will need to be considered in any expansion of the cemetery. Occurrence 2 is within land under the care, control and management of the Commonwealth Government, and future management has not been clarified. The greater part of the area of Stirling Crescent Bushland is managed by Main Roads Western Australia (MRWA) and the possible presence of threatened ecological communities will need to be considered in any future road works such as road widening.

The implementation of this recovery plan has the potential to have some limited social and economic impact, where occurrences are located on land not specifically managed for conservation. Recovery actions refer to continued liaison between stakeholders with regard to these areas.

Affected Interests: Occurrences of the 'shrublands and woodlands of the eastern side of the Swan Coastal Plain' occur within the local government authority of the City of Swan. They occur on land managed by the Metropolitan Cemeteries Board, DEC, Water Corporation (degraded areas only) and the Commonwealth Government.

Evaluation of the Plan's Performance: DEC, in conjunction with the Swan 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 community and reduce the level of threat, with the aim of reclassifying it from Critically Endangered to Endangered.

Criteria for success:

An increase of 10% or more in the area, and/or increase in the number of occurrences of this community under conservation management.

Maintenance in terms of diversity and basic composition of native plant taxa (as described in Gibson *et al.* 1994) taking account of natural change in the community over time. This will be measured as a loss of no more than 10% of the native plant taxa in any occurrence over the life of the plan.

Improvement in the condition of the habitat, in terms of reduction of numbers of exotic species and of other threatening processes as defined in this document. This will be measured as a reduction of 10% or more in the cover of exotic plant taxa in any occurrence.

Criteria for failure:

A decrease of 10% or more in the area covered by the community, and/or decline in the number of occurrences of this community under conservation management.

A decline in terms of diversity and basic composition of native plant taxa (as described in Gibson *et al.* 1994) taking account of natural change of the community over time. This will be measured as a loss of more than 10% of the native plant taxa in any one occurrence over the life of the plan.

Decline in the condition of the habitat, in terms of increase in numbers of exotic species and other threatening processes as defined in this document. This will be measured as an increase in the cover of exotic plant taxa of more than 10% in any occurrence of the community.

Recovery Actions:

1. Coordinate Recovery Actions	11. Implement dieback treatments
2. Liaise with current land managers to implement this IRP	12. Assess and monitor weed populations
3. Monitor the extent and boundaries of the community	13. Implement weed control, replanting and rehabilitation where necessary
4. Map habitat critical to survival	14. Ensure fences are constructed and maintained
5. Establish quadrats in Stirling Crescent Bushland	15. Design and conduct research
6. Disseminate information about the community	16. Report on success of management strategies
7. Install markers	17. Implement weed control and rehabilitation of Blackadder Creek
8. Design and implement flora monitoring program	18. Continue negotiations with regard to future management of Occurrence 1
9. Develop and implement fire management strategy	19. Implement drainage strategy
10. Monitor dieback and determine priority areas for dieback treatment	20. Seek to transfer management of Occurrence 2 to Conservation Commission

1. BACKGROUND

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

The plant community 'shrublands and woodlands of the eastern side of the Swan Coastal Plain' (Swan Coastal Plain community 20c; Gibson *et al.* 1994) occurs on the eastern side of the Swan Coastal Plain in the foothills of the Darling Scarp. The community reflects this transitional landform and soil zone between the Scarp and the Swan Coastal Plain, with many species such as *Templetonia biloba*, present in the community being more common on the Scarp. The assemblage also contains species such as *Neurachne alopecuroidea* more commonly associated with marri - wandoo woodlands on heavy soils (Gibson *et al.* 1994).

The community as described by Gibson *et al.* (1994) and DEP (1996) occurs as a shrubland, or a woodland of *Banksia attenuata* and *Banksia menziesii*, sometimes with *Allocasuarina fraseriana*. The shrub layer can include the species *Adenanthos cygnorum*, *Hibbertia huegelii*, *Scaevola repens* var. *repens*, *Allocasuarina humilis*, *Bossiaea eriocarpa*, *Hibbertia hypericoides* and *Stirlingia latifolia*. A suite of herbs including *Conostylis aurea*, *Trachymene pilosa*, *Lomandra hermaphrodita*, *Burchardia umbellata* and *Patersonia occidentalis*; and the sedges *Mesomelaena pseudostygia* and *Lyginia barbata* usually occur in the community. The weeds *Gladiolus caryophyllaceus* and *Ursinia anthemoides* are also common.

There are two confirmed occurrences of the community listed on DEC's threatened ecological communities database. Occurrence 1 is in an area known as Talbot Road Bushland in Stratton (Table 1), the second at Bushmead Rifle Range in Helena Valley (Occurrence 2). Other possible occurrences surrounding the intersection of the Great Eastern Highway bypass and Roe Highway were located during the integrated process of updating both the 'System 6' Conservation Through Reserves System Recommendations and the Ministry for Planning Urban Bushland Strategic Plan. The Stirling Crescent occurrences will require further investigation to confirm the identity of the communities present.

The updating of System 6 and the Urban Bushland Strategy resulted in Perth's Bushplan (Government of Western Australia 1998). Subsequently, the Bushplan process has evolved into Bush Forever (Government of Western Australia 2000) and all sites are listed as Bush Forever Sites. Bush Forever is concerned with the protection of regionally significant bushland and associated wetlands within the Swan Coastal Plain section of the Perth metropolitan region (State of Western Australia 2000).

Floristic plots were established in Occurrences 1 and 2 as part of the Swan Coastal Plain vegetation survey (Gibson *et al.* 1994) and the System 6 update respectively. Although statistical analysis of plot data indicates the two sites on the threatened ecological community database are the same community, there are some significant differences in structure and composition (Gibson *et al.* 1994; DEP 1996). These differences may be due to natural variation in the community (B. Keighery¹ personal communication). Differences may also be partly attributed to compositional changes in Occurrence 2 as a consequence of grazing (Ecologia Environmental Consultants 1991).

The ecological community the 'shrublands and woodlands of the eastern side of the Swan Coastal Plain' is located mainly on a geomorphological unit adjacent to the Darling Scarp described by Churchward and McArthur (1980) as the Forrestfield Unit of the Ridge Hill Shelf. The plant community is likely to have been rare even prior to extensive clearing of this geomorphological unit (Gibson *et al.* 1994; B. Keighery personal communication). The Forrestfield Unit consists of a belt one to three kilometres wide between the Darling and Gingin Scarps and the Darling Fault, from Walyunga National Park to Harvey. This system has been extensively cleared for agriculture, mining, forestry, and urban development. Only 3.1 percent of the original 14,414 hectares of the unit remained uncleared in 1986 (Ecologia Environmental Consultants 1991). Several other areas of uncleared vegetation remain on the Ridge Hill Shelf Unit, including at Yarloop, Maida Vale and Mundijong. However, none of these areas contain the plant community known as the 'shrublands and woodlands of the eastern side of the Swan Coastal Plain'.

¹ Bronwen Keighery: Department of Environment

Only about 123 hectares of the ‘shrublands and woodlands of the eastern side of the Swan Coastal Plain’ remain. Approximately 38 hectares is in the care, control and management of the Commonwealth of Australia for the use and requirements of the Department of Defence, about 40 hectares is vested in the City of Swan but managed by DEC, approximately 17 hectares is managed by the Cemeteries Board, approximately 11 hectares is unallocated Crown land, about six hectares is managed by MRWA and about two hectares is privately owned. Currently, there is a proposal to change the purpose of Reserve 23953 and Swan Location 11764 (Occurrence 1) to Conservation of Flora and Fauna and for the area to be transferred to the Conservation Commission.

Major threats to the community are weed invasion, dieback caused by *Phytophthora* species, clearing and frequent fire.

Table 1: Location, vesting, purpose and extent of occurrences

Occur No.	Location	Shire	Vesting	Purpose	Appr. area
1	Reserve 23953, Talbot Road, Stratton	City of Swan	City of Swan	Recreation	40 ha
	Unallocated Crown land (UCL) - Swan Location 11314 (adjacent to Reserve 23953)		-	UCL	11 ha
	Reserve 6955, City of Swan		Metropolitan Cemeteries Board	Cemetery	17 ha
2	Part Lot 9 on Diagram 4347, Helena Location 20a, Bushmead Rifle Range, Helena Valley	City of Swan	Commonwealth of Australia – Australian Defence Force	Commonwealth, Defence purposes	38 ha

1.2 Description of Occurrences

All occurrences of the ‘shrublands and woodlands of the eastern side of the Swan Coastal Plain’ occur within the City of Swan.

Occurrence 1 of the ‘shrublands and woodlands of the eastern side of the Swan Coastal Plain’ as mapped by Keighery and Keighery (1993) is on Talbot Road, Stratton. It occupies most of the central and western portions of Reserve 23953. This reserve covers a total of 66.77 hectares, of which community 20c covers approximately 40 hectares. Housing developments occur to the west, east, north, and to the south east of Reserve 23953. The community also extends into unallocated Crown land - Swan Location 11314, south west of Reserve 23953 (Keighery and Keighery 1993). This community occupies most of the 11 hectares covered by this area of Crown land. The partly cleared Cemetery Reserve 6955 is to the south of the unallocated Crown land and community 20c occupies about 17 ha of the total 23.67 ha area of this reserve. A compensation basin, other drainage areas, and an unused road reserve occur to the east of Swan Location 11314 and the cemetery reserve in areas managed by the Water Corporation (cleared area) or the City of Swan. Swan Location 11764, another area of unallocated Crown land, occurs adjacent to the south-eastern side of the Cemetery Reserve but this area does not contain the ‘shrublands and woodlands of the eastern side of the Swan Coastal Plain’. Part of this area has been cleared and mined for gravel historically.

All of the above listed areas are contiguous and consist mainly of remnant bushland. The area also supports other threatened ecological communities described by Gibson *et al.* (1994). In particular, the Critically Endangered Marri community *Corymbia calophylla* - *Xanthorrhoea preissii* woodlands and shrublands (Gibson *et al.* 1994 - community type 3c) occurs to the east of this community within Reserve 23953, in the south eastern corner of Reserve 6955, and in Swan Location 11764, unallocated Crown land (see below). This entire remnant consisting of four separate land titles is referred to as ‘Talbot Road Bushland’.

A 100 ha area that includes both of the Critically Endangered communities in the Talbot Road Bushland has been accepted for listing on the Register of the National Estate (Australian Heritage Commission 1997).

The occurrence in Talbot Road Bushland is mainly within class A Reserve 23953 for ‘Recreation’ and was initially managed by the City of Swan. In 2001, management of the bushland was transferred to DEC. The

City of Swan developed a management plan for this reserve (Safstrom and Taman 1999). The boundaries are all fenced and the site is used by walkers and for other passive recreation. This reserve has been burnt a number of times in recent years, most recently in February 2001. Dieback caused by *Phytophthora* species occurs in the remnant (Safstrom and Taman 1999), and laboratory testing has been undertaken to positively identify the pathogen. Only a small portion of Talbot Road Bushland is not infected with *Phytophthora* spp. Gravel has been extracted from the south-eastern corner of Reserve 23953.

The Priority three taxon (refer to Glossary for definitions) *Isopogon drummondii* and the priority four taxon *Thysanotus glaucus* occur in the 'shrublands and woodlands of the eastern side of the Swan Coastal Plain' at Talbot Road (Gibson *et al.* 1994). Talbot Road Bushland also contains seven species of frogs, and a diverse invertebrate fauna (How *et al.* 1996). The honey possum (*Tarsipes rostratus*), which is nearly extinct in the Perth Metropolitan region, has also been recorded in the Talbot Road Reserve (How *et al.* 1996).

Occurrence 2 in Bushmead Rifle Range has been subject to some historical disturbance. The main disturbance is likely to have been grazing by sheep (Ecologia Environmental Consultants 1991), which has encouraged weed invasion and may have resulted in changes in structure due to selective grazing of edible species. There is also evidence of quite extensive logging, and dieback may also have impacted the site although there has not been any laboratory testing for the presence of the disease. Walkers also occasionally use the area. The Bushmead site was used as a training area for the Australian Defence Forces' Transport Squadron prior to the time when the conservation significance of the area was noted (Ecologia Environmental Consultants 1991). The use of four wheel drive vehicles may also have impacted the bushland areas of the site to some extent through general disturbance and crushing of the vegetation and possibly spread of dieback.

The 'shrublands and woodlands of the eastern side of the Swan Coastal Plain' cover about 38 hectares of a total of 296.5 ha occupied by Bushmead Rifle Range. Another threatened ecological community - '*Banksia attenuata* over species rich dense shrublands' (Gibson *et al.* 1994 community type 20a; DEP 1996) occurs in the northern end of the Bushmead Rifle Range. This community is listed as Endangered. A 120 ha area within the 296 hectare Bushmead Rifle Range, that contains communities 20c and 20a, is on the Register of the National Estate (Australian Heritage Commission 1997).

The Bushmead Rifle Range is Commonwealth land for use by the Australian Defence Force, however, much of the land is no longer required for this purpose. In the past, the Department for Planning and Infrastructure negotiated to acquire the area but this was rejected. Currently, there are no active negotiations taking place. The land is fenced off from the general public.

Other possible occurrences of the 'shrublands and woodlands of the eastern side of the Swan Coastal Plain' community in the north and south road reserve of the Great Eastern Highway bypass at the intersection of the Midland bypass and Roe Highway and on adjacent private property were identified in Bush Forever (Bush Forever site number 481 - 'Stirling Crescent Bushland, Hazelmere'). The site is bound on the western side by Stirling Crescent. Recent surveys done by staff from DEC's Species and Communities Branch indicate that the 'shrublands and woodlands of the eastern side of the Swan Coastal Plain' community probably does not occur at this site, and that the site may be dominated by two other threatened communities- '*Eucalyptus calophylla* - *Kingia australis* woodlands on heavy soils' (community type 3a as Gibson *et al.* (1994); DEP (1996)), and '*Banksia attenuata* over species rich dense shrublands' (community type 20a as described in Gibson *et al.* (1994)). The presence or otherwise of this community at this site will need to be verified through floristic plots and data analysis as described in Gibson *et al.* (1994).

The bushland areas adjacent to the road junction are highly modified with high levels of grassy weeds, such as Veldt grass (*Ehrharta calycina*), and rubbish from surrounding areas. Weed invasion at the edge of the site is probably a consequence of road grading, and clearing of some vegetation for a power line. The bushland is highly fragmented as it is intersected by Great Eastern Highway and Roe highway and a significant area has been cleared for the construction of the bypass. A substantial area of the land around the current alignment of the junction is under the care, control and management of MRWA, and the road junction may be expanded in the future.

Biological and ecological characteristics

The majority of Occurrence 1 and all of Occurrence 2 are within the Forrestfield Geomorphological Unit of the Ridge Hill Shelf (Churchward and McArthur 1980). The Forrestfield unit is described by Churchward and McArthur (1980) as gently undulating spurs at the foot of the scarp, and is dominated by gravely and sandy soils. This area consists of coalescing alluvial fans at the bottom of the scarp and remnants of marine terraces (Ecologia Environmental Consultants 1991). Occurrences of this community occur mainly on sandy soils.

A very small proportion of Occurrence 1 on the western edge of Reserve 23953 is mapped on the Guildford Unit of the geomorphological group described as fluvial deposits (Churchward and McArthur 1980). The Guildford Unit is described as flat plain with medium textured deposits of yellow duplex soils, and is otherwise known as the Guildford clays (Churchward and McArthur 1980). This Unit consists of an older layer of alluvial clays on the eastern fringe of the Swan Coastal Plain.

Stirling Crescent Bushland occurs on the border between two geomorphological units. These are the Southern River unit, which is described as aeolian deposits, and the Forrestfield Unit. The Southern River Unit is described as occurring on sandplain with low dunes and many intervening swamps; iron and humus podzols, peats, and clay. This unit occurs where sand appears to have blown over alluvial soils and this results in the swamps having a clay base (Churchward and McArthur 1980).

The composition of the 'shrublands and woodlands of the eastern side of the Swan Coastal Plain' reflects the transitional zone between the Darling Scarp and the heavy soils on the eastern side of the Swan Coastal Plain (Gibson *et al.* 1994). Plant taxa that commonly occur in the community at the Talbot Road occurrence and those present in the plot at Bushmead Rifle Range are listed at Appendix 1 (from Gibson *et al.* 1994 and DEP 1996). The Talbot Road occurrence is generally in better condition and more diverse than at Bushmead. Weed cover in the two occurrences is generally low (B. Keighery personal communication).

The Talbot Road Bushland contains a variety of soil types from sandy silts (colluvium) to sand, according to Gozzard (1986). The structural units within this occurrence of the community vary from scrub to woodlands of *Banksia attenuata* over dense shrubs, possibly reflecting the variation in soils at this site.

Occurrence 2 at Bushmead Rifle Range consists of open forest of *Allocasuarina fraseriana* and *Banksia attenuata*, with varying dominance of *Allocasuarina*. The understorey in Occurrence 2 is much less diverse than that in Occurrence 1. In places *Adenanthos cygnorum* forms dense stands under the trees at the Bushmead site.

Stirling Crescent Bushland is similar to Bushmead in consisting of varying dominance of *Banksia attenuata*, *B. menziesii* and *A. fraseriana*. Plots have not been established within these occurrences. *Adenanthos cygnorum* is dominant in many places, especially adjacent to the road.

Species richness is high in the Occurrence at Talbot Road, with an average of 64 species occurring in nine plots of 100 m² for the plots located in the community in Reserve 23953 (Gibson *et al.* 1994). This is in keeping with the high species diversity noted for plant communities that occur on the Forrestfield Land Unit of the Ridge Hill Shelf (Keighery and Keighery 1993). An average of four weed species was recorded in these plots, which is relatively low. The diversity in the Bushmead occurrence is much lower, at 31 taxa recorded in the single plot in the occurrence (DEP 1996). The lower diversity may reflect natural variation in the community (B. Keighery personal communication), or be partly as a consequence of grazing, timber cutting and possibly dieback caused by *Phytophthora* species and other disturbances (Ecologia Environmental Consultants 1991). Only two weed species were recorded within the Bushmead plot, however, and this may indicate that the community has not been markedly altered by such disturbances (B. Keighery personal communication).

1.3 Hydrology

Drains from urbanised areas to the east flow into Talbot Road Bushland, and result in increased surface flow through the reserve in unconfined drains. Dieback disease caused by *Phytophthora* species occurs adjacent to

drains and may well be associated with enhanced surface and subsurface flow of water. The local Nyoongar people have cultural links with Blackadder Creek that runs through the Talbot Road Bushland, and will need to be consulted if any modifications to the drainage or creekline are planned.

1.4 Habitat critical to the survival and important occurrences

The critical habitat for the 'shrublands and woodlands of the eastern side of the Swan Coastal Plain' community comprises:

- the area of occupancy of known occurrences;
- areas of similar habitat within 200 metres of known occurrences, ie sandy to gravelly soils on the eastern Swan Coastal Plain and foothills of the Darling Scarp
- remnant vegetation that surrounds or links several occurrences (this is to provide habitat for pollinators or to allow them to move between occurrences).

Given that the community is listed as Critically Endangered, it is considered that all known occurrences are critical to the survival of the community.

1.5 Benefits to other species/ecological communities

There are two priority flora that are found within Occurrence 1. These are *Isopogon drummondii* (P3) and *Thysanotus glaucus* (P4).

Other threatened ecological communities, that are described in Gibson *et al.* (1994), are found in bushland adjacent to occurrences of the 'shrublands and woodlands of the eastern side of the Swan Coastal Plain'. 'Eucalyptus calophylla - Xanthorrhoea preissii woodlands and shrublands' ('community type 3c', listed as Critically Endangered in Western Australia, and as Endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*) occurs adjacent to the 'shrublands and woodlands of the eastern side of the Swan Coastal Plain' in Talbot Road Bushland. 'Banksia attenuata woodlands over species rich dense shrublands' ('community type 20a', listed as Endangered in Western Australia) occurs close to Occurrence 2.

Recovery actions implemented to improve the habitat quality, or the security of the community are likely to improve the status of any species within the community, and of any other threatened ecological communities that occur adjacent to the occurrences, within the same bushland.

1.6 Role and interests of indigenous people

An Aboriginal Sites Register maintained by the Department of Indigenous Affairs lists a number of significant sites within the two confirmed occurrences, and within Stirling Crescent Bushland where additional occurrences may exist. Blackadder Creek, which runs through Occurrence 1, is of special significance to indigenous communities as it is part of the Green Bullfrog Dreaming Track and home of the dreaming track of the Ancestors. Indigenous communities interested or involved in the region affected by this plan have been identified for Occurrence 1, and were involved in development of the management plan developed for the reserve that contains that occurrence (Talbot Road Bushland; Safstrom and Taman (1999)). The recommendations held in this plan are consistent with those held in that management plan. In addition, preliminary discussions have been held with indigenous people who have cultural links to the creekline that runs through Occurrence 1, with regard to future management of the creek. Occurrence 2 is on land under the care, control and management of the Commonwealth Government, and there are currently no active negotiations to transfer that land to another authority. The existence of other occurrences of the 'shrublands and woodlands of the eastern side of the Swan Coastal Plain' in other areas (that is, within Stirling Crescent Bushland) will require further investigation. Implementation of recovery actions under this plan includes consideration of the role and interests of indigenous communities.

1.7 Social and economic impacts

Part of Occurrence 1 occurs on land managed by the Metropolitan Cemeteries Board and the presence of this threatened ecological community will need to be considered in any expansion of the cemetery. Occurrence 2

is within land under the care, control and management of the Commonwealth Government, and future management has not been clarified. The greater part of the area of Stirling Crescent Bushland is managed by MRWA and the possible presence of threatened ecological communities will need to be considered in any future road works such as road widening.

The implementation of this recovery plan has the potential to have some limited social and economic impact, where occurrences are located on land not specifically managed for conservation. Recovery actions refer to continued liaison between stakeholders with regard to these areas.

1.8 Affected Interests

Occurrences of the 'shrublands and woodlands of the eastern side of the Swan Coastal Plain' occur within the local government authority of the City of Swan. They occur on land managed by Metropolitan Cemeteries Board, DEC, the Commonwealth Government, and may occur on land managed by private land owners and MRWA.

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 the 'shrublands and woodlands of the eastern side of the Swan Coastal Plain' is not specifically listed under any international agreement, the implementation of other international environmental responsibilities is not affected by this plan.

1.10 Evaluation of the Plan's Performance

DEC, in conjunction with the Swan Region Threatened Flora and Communities Recovery Team (SRTFCRT) 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 action will be documented accordingly.

1.11 Historical and current threatening processes

Clearing

Clearing for agriculture and urbanisation has been extensive on the Ridge Hill Shelf on the eastern side of the Swan Coastal Plain, where the 'shrublands and woodlands of the eastern side of the Swan Coastal Plain' community occurs. The community type is also likely to have been regionally rare prior to any clearing (Gibson *et al.* 1994). Hence, there are few remaining areas of this community.

The south-eastern portion of Reserve 23953 was historically cleared and used for gravel extraction. Bushland adjacent to Reserve 23953 at Talbot Road is not protected from clearing and is not managed for conservation. The Metropolitan Cemeteries Board may wish to clear the native bushland in Reserve 6955 for expansion unless an appropriate alternative area can be provided. The two areas of unallocated Crown land within the Talbot Road Bushland are not dedicated for any specific purpose. These areas are therefore afforded minimal on-ground management.

The Bushmead Rifle Range is currently under the care, control and management of the Commonwealth of Australia. However, as mentioned above, there have been negotiations with regard to have a significant proportion of the area, including the part covered by this community, transferred to the Conservation Commission of Western Australia as a conservation area.

In addition, further widening of Roe Highway and a possible bypass at Stirling Crescent Bushland have the potential to impact on the 'shrublands and woodlands of the eastern side of the Swan Coastal Plain', if the community is positively identified at the site.

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). If an appropriate frequency of fires is exceeded however, species that are obligate seeders may not have sufficient time to flower and produce seed. If the time between fires is too long, obligate seeders may become senescent and be unable to regenerate. Therefore, fires must occur at appropriate intervals and possibly the appropriate season and intensity to sustain the integrity of plant communities. As this community is not well studied, little is known of its requirements in terms of fire regime to maintain species composition. However, it is likely that the fire regimes in Occurrences 1 and 2 have been modified to more frequent fires, especially hot burns, since European settlement. The recent high frequency of fires in the Talbot Road Bushland (G. MacKinnon², personal communication) is likely to have favoured weeds and plants that propagate by resprouting.

All disturbance in remnants results in increasing weed invasion, particularly where remnants are small. Therefore, fire frequency should be minimised unless future studies indicate that fire is not occurring frequently enough. In addition, the risk of fire is increased by the presence of grassy weeds in the understorey, as they are likely to be more flammable than the original native species in the herb layer. The fire frequency in Talbot Road Bushland has been very high recently with the last major fire in February 2001 burning nearly 45 hectares. The increased number of fires may well be impacting the community in terms of structure, composition and level of weed invasion. The floristics of the site require monitoring so that the community's response to fire can be determined.

Fire within Occurrence 2 at Bushmead Rifle Range would increase weed levels but also may induce germination of seed stored within the soil. The area does not appear to have been burnt for many years and grazing by sheep may have caused the loss of some species from the site that now only occur as propagules in the soil.

Weed invasion

Weed invasion is usually enhanced by disturbances such as fires and grazing if weed propagules are present. The occurrences of this community are close to agricultural or urban areas that act as weed sources, and so would be vulnerable to weed invasion following any disturbance. However current levels of weeds in Occurrences 1 and 2 are still quite low.

There are tracks through occurrences of the community. Weeds have invaded to varying extents along these tracks and such areas should be considered priority areas for weed control. In particular, piles of soil scraped from tracks generally contain high concentrations of weeds and act as a source of weed invasion. Such piles should be avoided when tracks are cleared, or be removed where they already exist.

A weed control program would be necessary to maintain or improve the condition of occurrences of the community in the long term. Brown and Brooks (2002) 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 (adapted from Brown and Brooks 2002):

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; and
4. rehabilitation through reintroduction of local native species where areas are no longer capable of regenerating following weed control.

A disused gravel pit occurs in the south-east portion of Reserve 23953. This area contains some significant infestations of weeds.

² Grant MacKinnon: City of Swan

Grazing

The Bushmead Rifle Range has been grazed by sizeable flocks of sheep over the years and this may have altered the structure and composition of the plant community by trampling, selective grazing and facilitated weed invasion.

Rabbits have impacted parts of Talbot Road Bushland in the past, particularly where recent fires have decreased the density of understorey vegetation. They selectively graze more palatable species and spread weeds in their droppings. A rabbit control program has been undertaken using fumigation and ripping of the burrows in the area of the community managed by the Metropolitan Cemeteries Board (Reserve 6955).

Disease introduction

The community type appears to be quite susceptible to dieback caused by *Phytophthora* species and the pathogen is common in Talbot Road Bushland (Safstrom and Taman 1999). Further spread or amplification of the disease should therefore be minimised wherever the community occurs by ensuring good hygiene procedures. This would involve wash-down of any equipment used adjacent to the community. The drainage waters flowing through Occurrence 1 may be carrying the pathogen and, as discussed below, this may require specific management.

The community in Bushmead Rifle Range may also have been impacted by dieback historically. This may have been introduced and/or spread by vehicles, sheep or walkers.

Dieback causes loss of susceptible species and may result in altered composition and structure of vegetation. The areas of infection will need to be mapped in Bushmead Rifle Range to help guide future management such as rehabilitation, treatment of priority areas with phosphite that is used to control dieback, and closure of specific tracks where vehicle or foot access may spread or amplify dieback impact.

The presence of dieback was assessed and found on the western side of the Roe Highway in Stirling Crescent Bushland but a negative result for dieback presence was obtained for the eastern side of Roe Highway in the Stirling Crescent area (John Meharry³, personal communication).

Hydrological changes

Water from urban areas to the east of Talbot Road Bushland is channeled into Reserve 23953. This may be implicated in introducing and/or amplifying dieback in the reserve and alternative strategies for drainage need to be investigated.

Pollution

The pollution of the surface waters with animal droppings or fertilisers would increase nutrient levels and hence, favor weed invasion because introduced species are generally adapted to higher nutrient levels than native Australian plants. Surface runoff of other pollutants into the community from surrounding lands is also possible.

Erosion by wind and water

The unconfined drain through the Talbot Road Bushland is resulting in noticeable levels of erosion and redeposition of topsoil. This drain flows through the southern end of this community and other means of channeling water should be considered.

1.12 Conservation status

The community meets criterion B (ii) as follows, for Critically Endangered:

³ John Meharry, Sustainable Forest Management Division, CALM

Current distribution is limited and there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes. The community is also listed as Endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*. The community name as listed under that Act is 'Shrublands and woodlands of the eastern Swan Coastal Plain'.

1.13 Strategy 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 ecology of the community to develop further understanding about the management actions required to maintain or improve the condition of the community.

2. Recovery Objective and Criteria

2.1 Objective

To maintain or improve the overall condition of the 'shrublands and woodlands of the eastern side of the Swan Coastal Plain' and reduce the level of threat with the aim of downgrading it from Critically Endangered to Endangered.

2.1.1 Criteria for success

An increase of 10% or more in the area, and/or increase in the number of occurrences of this community under conservation management.

Maintenance in terms of diversity and basic composition of native plant taxa (as described in Gibson *et al.* 1994) taking account of natural change in the community over time. This will be measured as a loss of no more than 10% of the native plant taxa in any occurrence over the life of the plan as a consequence of identifiable threats.

Improvement in the condition of the habitat, in terms of reduction of numbers of exotic species and of other threatening processes as defined in this document. This will be measured as a reduction of 10% or more in the cover of exotic plant taxa in any occurrence.

2.1.2 Criterion for failure

A decrease of 10% or more in the area covered by the community, and/or decline in the number of occurrences of this community under conservation management.

A decline in terms of diversity and basic composition of native plant taxa (as described in Gibson *et al.* 1994) taking account of natural change of the community over time. This will be measured as a loss of more than 10% of the native plant taxa in any one occurrence over the life of the plan.

Decline in the condition of the habitat, in terms of increase in numbers of exotic species and other threatening processes as defined in this document. This will be measured as an increase in the cover of exotic plant taxa of more than 10% in any occurrence of the community.

3. Recovery Actions

The responsible authority is frequently listed as the relevant DEC District. This refers largely to initiating and guiding actions. However, in general the relevant DEC District, in cooperation with the Species and Communities Branch (SCB) and the SRTFCRT share the primary responsibility for securing funds for, and/or coordinating the implementation of, recovery actions.

Wherever applicable, the detailed actions listed in the Management Plan for Talbot Road Bushland (Safstrom and Taman 1999) will be adopted for Occurrence 1.

Existing Recovery Actions

Notification letters that included details about the 'shrublands and woodlands of the eastern side of the Swan Coastal Plain', and a map were sent in March 2005 to all relevant land owners and managers.

Recovery actions have mainly been implemented at Talbot Road Bushland with support from the City of Swan, the Environmental Weeds Action Network, DEC Perth Hills District and the Friends of Talbot Road Reserve.

From 1999 until 2002 an Environmental Weeds Action Network project officer worked with the Friends of Talbot Road Reserve, City of Swan and DEC staff to map the distribution of the serious perennial weeds at Talbot Road Bushland (Occurrence 1), to implement control programs and to monitor the effectiveness of those programs. In April 2004 DEC's Urban Nature program adopted and has continued much of that work. *Watsonia* species and Love grass (*Eragrostis* species) are largely under control and work is continuing on controlling Veld grass (*Ehrharta* species), *Hesperantha* spp. and *Freesia* spp. Where weeds have been controlled in good condition bushland, native species have started to recolonise. However, along the more degraded edges annual weeds have colonised and dominated over native species.

A restoration plan for these edges has been developed by staff from Urban Nature and will be implemented over the next couple of years in conjunction with the City of Swan, the Friends of Talbot Rd Bushland, and DEC's Perth Hills District. 'Work for the Dole' groups conducted hand weeding in 2003. Transects were established in areas of large infestations to monitor the changes in species composition with the removal of the perennial weeds. With the removal of the perennial weeds, annual grasses and herbs are beginning to invade. Soil dumps act as points of introduction of weed propagules and have been removed.

The Talbot Road Management Plan was completed in July 1999 and several recommendations in the plan, also recommended in the previous IRP, have been implemented. Dieback markers were installed in 2000. Seed collections of native species within the reserve were conducted during the last four to five years. Several tracks have been closed within the reserve, such as along the southern edge of the reserve. In 2001, a Green Corp group rehabilitated several of these tracks by initially weeding, brushing, direct seeding with local native species and then spraying the tracks with smoke water to encourage germination. The tracks were then signposted to inform recreational users of the rehabilitation and closure of tracks. In addition to track rehabilitation, the gravel pit located in the south eastern corner of the reserve has been rehabilitated.

Several information sheets and pamphlets have been produced by DEC and World Wide Fund for Nature (WWF) on the Talbot Road Bushland and on the woodlands of the Swan Coastal Plain and includes a description of the 'shrublands and woodlands of the eastern side of the Swan Coastal Plain' community. Pamphlets on Talbot Road Bushland were distributed to houses neighboring the Talbot Road Reserve. Some of the weed management programs have been written up as case studies (Brown and Brooks 2002) and the site has been used as a demonstration site on weed management field days.

Future Recovery Actions

3.1 Coordinate Recovery Actions

The Swan Region Threatened Flora and Communities Recovery Team (SRTFCRT) will continue to coordinate recovery actions for the 'shrublands and woodlands of the eastern side of the Swan Coastal Plain' community and other Declared Rare Flora and Threatened Ecological Communities in their region. They will include information on progress in their annual reports to DEC's Corporate Executive and funding bodies. In addition, recovery actions for Talbot Road Bushland (Occurrence 1) will continue to be coordinated through bi-monthly meetings attended by representatives of Urban Nature (DEC), City of Swan, DEC Perth Hills District and Friends of Talbot Road Reserve.

Responsibility: DEC (SRTFCRT), DEC Swan Region
Cost: \$1,000 per year (the costs of attending meetings is met by members of the groups)
Completion date: Ongoing

3.2 Liaise with land managers and interested groups to implement this IRP

Part of Occurrence 1 and all of Occurrence 2 are currently managed by authorities other than DEC, and also occur on unallocated Crown land.

Stakeholders who are involved in the management of the Talbot Road Bushland include the Friends of Talbot Road Reserve, the City of Swan, the Blackadder/Woodbridge Creek Catchment Group, and the local Nyoongar people who have cultural links to the Blackadder Creek that runs through Talbot Road Bushland. The care, control and management of Occurrence 2 currently lies with the Commonwealth Government, so the Commonwealth is the major stakeholder for this area. Stakeholders may include Main Roads WA and private landholders, if the Stirling Crescent Bushland is confirmed to contain occurrences of this community.

The involvement of land managers, and relevant Aboriginal and local community groups in the recovery of the community wherever possible and practical is therefore essential to the recovery process.

Responsibility: DEC (Perth Hills District; Urban Nature; SCB)
Cost: Costs of all liaison \$2000 pa
Completion date: Ongoing

3.3 Monitor the extent and boundaries of the community

Occurrences will ideally be monitored every two years. Boundaries can be determined from current aerial photographs and minimal on site checking. Additional occurrences will be entered onto the Threatened Ecological Communities (TEC) Database, including boundary information, condition and threatening processes.

The boundaries of occurrences currently on the TEC Database have been mapped (Occurrence 1 by Keighery and Keighery 1993; Occurrence 2 from plot data and current aerial photographs by V. English - unpublished data; possible occurrences at Stirling Crescent Bushland that are mentioned in Bush Forever require further investigation).

Responsibility: DEC, (Perth Hills District; Urban Nature; SCB) in consultation with land managers
Cost: \$1500 Year 2 and 4
Completion date: Ongoing

3.4 Map habitat critical to survival

Although habitat critical to survival 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 (including at Stirling Crescent Bushland), then this habitat will also be determined and mapped for these locations.

Responsibility: DEC, (Perth Hills District; Urban Nature; SCB)
Cost: \$1,000 in first year
Completion date: Year 1, possibly ongoing for any additional occurrences that are identified.

3.5 Establish quadrats in Stirling Crescent Bushland

Permanent quadrats will be established at Stirling Crescent Bushland to confirm if occurrences of the 'shrublands and woodlands of the eastern side of the Swan Coastal Plain' community exist at the site. Permanent plots will be established as per Gibson *et al.* (1994), and all flora within the quadrat will be recorded. Data will be analysed using methods as described in Gibson *et al.* (1994).

Responsibility: DEC, (Perth Hills District; SCB) in consultation with land managers
Cost: \$3,000 in first year; cost of liaison included in 3.2
Completion date: Year 1

3.6 Disseminate information about the community

To prevent accidental destruction of the community and gain public support for its conservation, information about the community will be provided by local DEC staff to all stakeholders including managers of land that contains the community and other interested groups. This will include maps indicating the location of the community, and information about the conservation value of the community.

DEC staff will ensure regular liaison with relevant land managers to ensure threatened ecological community information is up to date.

A publicity campaign that includes the use of signs and information shelters in reserves and information in the local media, will be undertaken to encourage awareness about this threatened ecological community. It is proposed that information shelters will be erected in Talbot Road Bushland to provide information on the conservation values of the reserve to recreational users.

Responsibility: DEC (Strategic Development and Corporate Affairs (SDCA), Urban Nature, Perth Hills District, SCB)
Cost: \$1,000 in Year 1 (including money to build information shelter), \$500 in Year 2
Completion date: Ongoing

3.7 Install markers where required

To reduce the likelihood of accidental destruction, DEC will mark, or encourage land managers to mark, roadside occurrences, and occurrences of this ecological community located on tracks or firebreaks, with the same pegs used to mark threatened flora.

Responsibility: DEC (Perth Hills District; SCB), in consultation with relevant land managers
Cost: \$500 in Year 1
Completion date: Year 1

3.8 Design and implement a flora monitoring program

Currently, monitoring is conducted only at Talbot Road Bushland (Occurrence 1). Transects were established within the reserve to monitor community composition following initial weed control in 1999 by the Environmental Weeds Action Network. Since 2004 these transects have been monitored yearly by DEC's Urban Nature (R. Miles⁴, pers. comm.).

Ideally, occurrences will be monitored bi-annually to provide information on condition. This information will be added to the TEC database.

Floristic plots were established in occurrences 1 and 2 as part of the Gibson *et al.* 1994 survey. A total of 10 plots occur in these occurrence (Gibson *et al.* 1994; DEP 1996). One plot in the Banksia woodland and one in the shrubland in Occurrence 1, and the single plot in Occurrence 2 will be monitored to help determine changes in condition, Photographic monitoring sites will also be established. Photo monitoring will entail taking photographs at the monitoring plots as well as at several other plots or points in each area. All native and weed species were originally recorded, but density or cover values for each species were not included in these data and will be essential for determining changes over time (eg as a result of too frequent fire). Line intercept and photographic methods as described in Hopkins *et al.* (1987) could be utilised to monitor these parameters, using permanent plots already in place from other surveys (Gibson *et al.* 1994; DEP 1996). The floristic plots will only pick up gross changes at a very local level. Condition is a reflection of the major threatening process including dieback, inappropriate fire regimes, and weed invasion.

⁴ Renee Miles: CALM Urban Nature

Data will be entered on a database program and unfamiliar plant species will be collected (except identified Declared Rare Flora).

Responsibility: DEC (Perth Hills District; Urban Nature; SCB) in consultation with land managers
Cost: \$2,500 Year 1, 3, 5; \$1,500 Year 2 and 4 (includes monitoring of weed transects every year)
Completion date: Ongoing

3.9 Develop and Implement a Fire Management Strategy

3.9.1 Develop and implement a fire management strategy that encompasses the following (3.9.1-3.9.5)

There is a need for research into the recovery of the community from fire (to be completed under Action 3.8 - flora monitoring program), and to determine the implications of findings for management. Fire histories have been recorded for Talbot Road Bushland (Occurrence 1) using a differential GPS to map fire boundaries. Fire histories using this method will be undertaken for all other occurrences and updated annually. As little is known of the response of the community to fire, no planned burn should be implemented for Occurrence 1 for the life of this IRP, unless results of future studies suggest it is necessary.

A fire response plan is being updated for Reserve 23953 by the Fire and Emergency Services Authority of WA (FESA), City of Swan and DEC. It specifies no planned burns without consultation with DEC, no construction of new fire-breaks, a fire-fighting strategy, implementation of dieback hygiene for all vehicles, routine fuel and weed monitoring, and maintenance of fire-breaks. This updated plan is in draft (F. Felton⁵, personal communication). A similar plan will be developed for other occurrences, using the plan for Talbot Road Bushland as a guide and this will require liaison with all stakeholders.

Responsibility: DEC (Perth Hills District) in consultation with all stakeholders
Cost: \$1500 for development of plan for Occurrence 2 and update of plan for Occurrence 1; costs of liaison included in 3.2
Completion date: Year 1

3.9.2 Ensure maintenance of strategic firebreaks to help prevent fire spreading to the community

Fire-breaks are maintained by the City of Swan in Talbot Road Bushland, and maintenance is specified as routine in the Fire Management Strategy for the area. A number of tracks in this occurrence may need to be rehabilitated, if not required as part of the system of strategic fire-breaks, to prevent spread or intensification of dieback, further weed invasion etc. Wherever possible, herbicides will be used to maintain fire-breaks to reduce the spread of dieback and weeds. DEC District staff will ideally be involved in planning fire-break construction and maintenance for occurrences of the community. No new fire-breaks should be constructed within this community.

No new fire-breaks will be constructed or existing breaks upgraded around occurrences of this community on DEC managed lands (if occurrences are transferred to the Conservation Commission) without the approval of the Director of Nature Conservation.

Responsibility: DEC (Perth Hills District) in consultation with managers of occurrences; liaison with surrounding landholders
Cost: Cost of maintaining fire-breaks \$1,200 pa; costs of liaison included in 3.2
Completion date: Ongoing

⁵ Fiona Felton, CALM, Swan Coastal District.

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

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

Responsibility: DEC (Perth Hills District); liaison with surrounding landholders
Cost: Costs of liaison included in 3.2
Completion date: Ongoing

3.9.4 Ensure fire suppression actions do not impact the community

DEC will liaise with fire-fighting authorities to ensure that they recognise the importance of not constructing new tracks during their operations, including during wildfires. The use of heavy machinery to create new fire-breaks within the community should be avoided as additional disturbance would encourage further weed invasion, and chemicals that may be toxic to the community should not be used. Guidelines for appropriate fire suppression actions have been developed for Reserve 23953 and should be applied to the remainder of Talbot Road Bushland. Similar guidelines should be developed for remnants that contain other occurrences, based on those developed for Talbot Road Bushland.

The draft Fire Management Plan for Talbot Road Bushland specifies no new fire-breaks, implementing dieback hygiene, and notes the location of significant areas that include the locations of Priority taxa, and threatened ecological communities.

The responsibility for managing fires depends upon who manages the land. DEC is responsible for fire management on land managed by DEC outside the metropolitan gazetted fire district, while Fire and Emergency Services Authority of WA (FESA) is responsible for this in gazetted areas and non-DEC-land (L. Sage⁶, personal communication).

Prescribed burning of Occurrences should not be carried out until the results of the fire response research is complete (L. Sage, personal communication). Therefore the TEC should be listed as 'no plan burn' in the interim. A DEC District 'Fire Emergency Availability' officer will be present at wildfires that may potentially threaten the TEC, with more staff and/or crews dispatched if required (L. Sage, personal communication).

Responsibility: DEC (Perth Hills District); in liaison with local Bush Fire Brigades and Fire and Rescue Service
Cost: Costs of preparation of guidelines and liaison included in 3.2 and 3.7; additional funds for District staff to attend fires in the community - \$500 pa
Completion date: Ongoing

3.9.5 Ensure hygiene conditions

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

Standard practice should ensure that all vehicles using tracks through remnants that contain the community be free of soil, or plant propagules, and that no vehicles drive off existing tracks within these remnants.

Responsibility: All personnel operating machinery in the occurrences
Cost: Costs of all liaison to be undertaken by DEC (Perth Hills District), is included in 3.2; other costs to be underwritten by user of machinery
Completion date: Ongoing

⁶ Leigh Sage, CALM Swan Coastal District

3.10 Monitor dieback and determine priority areas for dieback treatment

Dieback disease was mapped by DEC's Forest Management Branch at Occurrence 1 in 2004 (R. Miles, personal communication) and is monitored regularly. Dieback disease was assessed and found on the western side of the Roe Highway in Stirling Crescent Bushland but a negative result for dieback presence was obtained for the eastern side of Roe Highway in the Stirling Crescent area.

Priority areas for dieback treatment in Occurrence 1 are indicated in Safstrom and Taman (1999). Data on dieback presence and impact, and future biodiversity implications (such as loss or decline of Priority taxa, or structurally or functionally important taxa) are likely to be important determinants of the priority of treatment of individual occurrences. Occurrence 1 is a higher priority for dieback treatment as it is in the best condition, contains a number of Priority flora, and is currently showing signs of dieback infection. The presence of dieback disease will be confirmed through mapping, collection and testing of suspected soil and plant samples. Priority areas for dieback treatment in the community will be determined using the Department of Conservation and Land Management's (now DEC) Dieback Management Guidelines (CALM 1999).

The dieback front in Occurrence 1 will be monitored at least every five years in summer and flagging marking the front will be replaced. Additional plot information (refer 3.8) will provide useful monitoring data for all sites.

Responsibility: DEC (Perth Hills District) in consultation with managers of occurrences
Cost: \$1500 in year 1
Completion date: Ongoing

3.11 Implement dieback treatments

Safstrom and Taman (1999) describe a dieback treatment strategy for Talbot Road Bushland. With the cooperation of land managers, such a strategy should initially be implemented in the highest priority areas of Occurrence 1. The protocol will incorporate results of monitoring from current and future methods of experimental dieback treatments.

The requirement for disease treatment at Occurrence 2 will be evaluated. Should the presence of the 'shrublands and woodlands of the eastern side of the Swan Coastal Plain' be confirmed at Stirling Crescent Bushland, then the requirement for treatment to manage the disease will be assessed.

Responsibility: DEC (Perth Hills District; Dieback Hygiene and Mapping Service, Science Division, SCB) in consultation with land managers
Cost: \$1000 pa
Completion date: Ongoing

3.12 Assess and monitor weed populations

Boundaries of weed populations will be accurately mapped using a differential GPS and appropriate herbicides or other method of weed control determined for each occurrence. Transects established to monitor weed levels will be monitored annually.

Local groups will be encouraged to participate in these surveys.

Responsibility: DEC (Perth Hills District; Urban Nature) in consultation with relevant land managers
Cost: \$1,000 every second year for monitoring boundaries of weeds that pose the greatest threat to the community. Monitoring of weed densities to be incorporated into Action 3.8
Completion date: Ongoing

3.13 Implement weed control, replanting and rehabilitation where necessary

Weed control of the major perennial weeds has been conducted at Occurrence 1, with continual monitoring to detect re-infestation. Where perennial weeds have been removed from highly degraded areas that are incapable of regenerating naturally, the sites should be replanted with appropriate local species. High priority actions may also include the removal of piles of soil scraped from tracks that contain high concentrations of weeds and act as a source of weed invasion. Local species that are suitable for replanting will be identified from Plot data for each occurrence held in Gibson *et al.* (1994) and DEP (1996), and from monitoring data collected under Action 3.8. Seed from local species collected from the reserve will be used in rehabilitation plantings.

Occurrence 1 is a high priority for weed control and management as weeds are in low numbers and the vegetation generally is in better condition than that in Occurrence 2. The issues of weed control, rehabilitation and rubbish collection are considered in detail for Occurrence 1 in Safstrom and Taman (1999).

Responsibility: DEC (Perth Hills District; Urban Nature) in liaison with managers
Cost: \$5,000 pa
Completion date: Ongoing

3.14 Seek to ensure fences are constructed and maintained

Appropriate fencing for all occurrences will be designed to permit authorised vehicle access for operational purposes, allow foot access and protect rehabilitation areas in high usage zones where necessary.

Occurrence 1 has been fenced but will require continual maintenance. The perimeter of the Bushmead Rifle Range is already fenced, but the area may be split into a number of lots managed by different authorities. Appropriate locations for fences to protect the 'shrublands and woodlands of the eastern side of the Swan Coastal Plain' will be determined once these new cadastral boundaries are determined. Consultation will be required with owners of any occurrences located on land managed by authorities other than DEC to determine appropriate locations for fences.

Responsibility: DEC (Perth Hills District) in consultation with land managers
Cost: \$5,000 pa for maintenance; costs of liaison included in 3.2
Completion date: Occurrence 1 ongoing; Occurrence 2 – timing to be determined. As appropriate for any other occurrences identified.

3.15 Design and conduct research

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

1. The impact of weeds on the community.
2. The role of disturbance in regeneration of the community.
3. The recovery of the community following wild fires (this will be considered in the Fire Management Plan developed under 3.9).
4. Investigations into significant biological processes in the community eg pollination biology, germination requirements, longevity and time taken to reach maturity of important plant taxa in the community.
5. Investigation into changes in community composition following weed control

Responsibility: DEC (Science Division; Perth Hills District; Urban Nature; SCB) in consultation with land managers
Cost: \$10,000 pa to initiate appropriate programs outlined above
Completion date: Ongoing

3.16 Report on success of management strategies

Reporting will be done as part of annual reports prepared by the SRTFCRT for DEC's Corporate Executive. A final report will be presented as part of or complementary to the revised recovery plan for the community, if this plan is updated in future.

Responsibility: DEC (Perth Hills District; SCB); SRTFCRT
Cost: \$2,000 in Year 5
Completion date: Year 5

Specific Management Actions - Talbot Road Bushland - Occurrence 1

3.17 Implement weed control and rehabilitation of Blackadder Creek

Sections of Blackadder Creek within the reserve are degraded by infestations of invasive weeds such as *Watsonia* species and lovegrass. A proposal is currently being developed to control the weeds and rehabilitate the creekline with appropriated local species. The Nyoongar Aboriginal people have cultural links to Blackadder Creek that runs through Talbot Road Bushland and will be consulted with regard to any weed control and rehabilitation of the creek in the Talbot Road Bushland. In May 2005, staff from Urban Nature met with staff from DEC's Indigenous Heritage Unit, and two Nyoongar elders at the Blackadder Creek to talk about the cultural and aboriginal significance of the area, and to discuss options for rehabilitation of the creekline.

Responsibility: DEC (Perth Hills District; SCB; Urban Nature); SRTFCRT in consultation with appropriate indigenous groups and other stakeholders
Cost: \$750 Year 1; \$2,000 Year 2, 3, 4, and 5; costs of liaison to be included in 3.2
Completion date: Year 5

3.18 Continue negotiations with regard to future management of Occurrence 1

The tenure of all land parcels in Talbot Road Bushland is considered in Bush Forever (Government of Western Australia 2000) and in the Management Plan (Safstrom and Taman 1999).

Negotiations are underway to amalgamate Swan Locations 11314 and parts of Lot 11764 (these Lots are the northern and southern areas of unallocated Crown land within the remnant that also contains Reserve 23953) with Reserve 23953, and it is planned that the amalgamated area will be transferred to the Conservation Commission for the Conservation of Flora and Fauna.

The future of the remaining bushland that occurs within Reserve 6995, and part of Lot 11764 to the east of Reserve 6955 is under negotiation, with a portion of the area being considered for clearing for the purpose of cemetery. Department of Planning and Infrastructure, DEC, the City of Swan, the Cemeteries Board and other authorities and interested groups are involved in these discussions. DEC will continue to liaise with other stakeholders in regard to this issue.

Responsibility: DEC (Perth Hills District; Land and External Funding Unit); City of Swan, Department of Planning and Infrastructure, Cemeteries Board
Cost: Costs of liaison included in 3.2
Completion date: To be determined

3.19 Implement drainage strategy

The unconfined drain through Talbot Road Bushland may be spreading and causing intensification of dieback in this and other adjacent plant communities (R. Miles, V. English personal observation). A strategy to confine or divert the drainage waters into the Water Corporation compensation basin so that the hydrology of adjacent areas returns to a more natural state, will be implemented as part of that the plan being developed by Safstrom and Taman (1999). The Swan City Council through liaison with DEC (Urban Nature) has

agreed to fund the cost of the diversion (\$52 000) in their 2006/7 budget. The Nyoongar Aboriginal people have cultural links to Blackadder Creek that runs through the remnant and will be consulted with regard to any changes to drainage in the Talbot Road Bushland.

Responsibility: DEC (Perth Hills District); City of Swan; Water Corporation, in consultation with appropriate Aboriginal groups
Cost: Costs of liaison included in 3.2; diversion of drainage \$52,000 across Year 2 and Year 3
Completion date: Year 2 and 3

Specific Management Actions - Bushmead Rifle Range - Occurrence 2

3.20 Seek to transfer vesting of Occurrence 2 to Conservation Commission

DEC will continue to negotiate to have the care, control and management of threatened ecological communities and other bushland within Bushmead Rifle Range declared a Class A reserve for the purpose of 'Conservation of Flora and Fauna' vested in the Conservation Commission of Western Australia.

Previous negotiations between the Ministry for Planning (now Department of Planning and Infrastructure (DPI)) and the Commonwealth to have the ownership of the whole rifle range transferred to the WA Planning Commission were not resolved. DEC will continue to seek to have portions of the rifle range area transferred to the CCWA. The endangered community '*Banksia attenuata* over species rich dense shrublands' as described by Gibson *et al.* (1994) also occurs in the rifle range area. Ideally, areas of TECs, and the remainder of the remnant bushland that provides a buffer for them will be acquired as a conservation reserve.

Responsibility: DEC (Land and External Funding Unit); in liaison with Commonwealth of Australia and DPI
Cost: Costs of liaison included in 3.2
Completion date: To be determined

Table 3: Summary of costs for each recovery action

Recovery Action	Year 1	Year 2	Year 3	Year 4	Year 5
1. Coordinate Recovery Actions	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000
2. Liaise with current land managers	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000
3. Monitor the extent and boundaries of the community	-	\$1,500	-	\$1,500	-
4. Map habitat critical to survival	\$1,000				
5. Establish permanent quadrats in Stirling Crescent Bushland	\$3,000	-	-	-	-
6. Disseminate information about the community	\$1,000	\$500	-	-	-
7. Install markers	\$500	-	-	-	-
8. Design and implement flora management program	\$2,500	\$1,500	\$2,500	\$1,500	\$2,500
9. Develop and implement fire management strategy	\$3,200	\$1,700	\$1,700	\$1,700	\$1,700
10. Monitor dieback and determine priority areas for treatment	\$1,500	-	-	-	-
11. Implement dieback treatments	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000
12. Assess and monitor weed populations	-	\$1,000	-	\$1,000	-
13. Implement weed control, replanting and rehabilitation where necessary	\$5,000	\$5,000	\$5,000	\$5,000	\$5,000
14. Seek to ensure fences are constructed and maintained	\$5,000	\$5,000	\$5,000	\$5,000	\$5,000
15. Design and conduct research	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000
16. Report on success of management strategies					\$2,000
17. Implement weed control and rehabilitation of Blackadder Creek	\$750	\$2,000	\$2,000	\$2,000	\$2,000
18. Continue negotiations on tenure of Occurrence 1	-	-	-	-	-
19. Implement drainage strategy	-	\$26,000	\$26,000	-	-
20. Seek to transfer Occurrence 2 to Conservation Commission of WA	-	-	-	-	-
TOTAL	\$37,450	\$58,200	\$56,200	\$31,700	\$32,200

Summary of costs over three years Total \$215,750

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APPENDIX 1

Plant taxa that occurred in at least 50% of plots in the community the 'shrublands and woodlands of the eastern side of the Swan Coastal Plain' in Reserve 23953 - Occurrence 1 (from Gibson *et al.* 1994), and taxa present in the single plot in the Occurrence 2 (from DEP 1996).

Species	Common in Occurrence 1	Present in Occurrence 2
<i>Acacia auronitens</i>	+	
<i>Acacia sessilis</i>	+	
<i>Acacia willdenowiana</i>	+	
<i>Adenanthos cygnorum</i>		+
<i>Allocasuarina fraseriana</i>		+
<i>Allocasuarina humilis</i>	+	
<i>Amphipogon turbinatus</i>	+	
<i>Anigozanthus humilis</i>		+
<i>Anigozanthus manglesii</i>	+	
<i>Arnocrinum preissii</i>	+	
<i>Astroloma stromarrhena</i>		+
<i>Banksia attenuata</i>		+
<i>Banksia menziesii</i>		+
<i>Bossiaea eriocarpa</i>	+	
* <i>Briza maxima</i>	+	
<i>Burchardia umbellata</i>	+	+
<i>Caladenia flava</i>		+
<i>Calytrix angulata</i>	+	
<i>Caustis dioica</i>		+
<i>Chamaescilla corymbosa</i>	+	
<i>Conospermum stoechadis</i>	+	
<i>Conostylis aculeata</i>	+	
<i>Conostylis aurea</i>	+	+
<i>Conostylis juncea</i>		+
<i>Conostylis setosa</i>		+
<i>Dasypogon bromeliifolius</i>	+	+
<i>Dasypogon obliquifolius</i>		+
<i>Drosera glandulifera</i>	+	
<i>Drosera stolonifera</i>	+	+
<i>Dryandra nivea</i>	+	
<i>Eremaea asterocarpa</i> subsp. <i>asterocarpa</i>	+	
* <i>Eriostemon spicatus</i>	+	
* <i>Gladiolus caryophyllaceus</i>		+
<i>Gompholobium tomentosum</i>	+	
<i>Haemodorum laxum</i>	+	
<i>Hibbertia hypericoides</i>	+	
<i>Hibbertia huegelii</i>		+
<i>Hybanthus calycinus</i>	+	
<i>Hypolaena exsulca</i>	+	
* <i>Hypochoeris glabra</i>	+	
<i>Isopogon drummondii</i>		+
<i>Isotropis cuneifolia</i>	+	
<i>Jacksonia densiflora</i> / <i>floribunda</i> complex	+	
<i>Jacksonia sternbergiana</i>	+	
<i>Johnsonia pubescens</i>		+
<i>Lambertia multiflora</i>	var. <i>darlingensis</i> ms	+
<i>Laxmannia sessiliflora</i>	+	
subsp. <i>australis</i>		
<i>Lepidosperma exsul</i>		+

Species	Common in Occurrence 1	Present in Occurrence 2
<i>Leporella fimbriata</i>	+	
<i>Lomandra hermaphrodita</i>	+	+
<i>Loxocarya flexuosa</i>	+	
<i>Lyginia barbata</i>	+	+
<i>Mesomelaena pseudostygia</i>	+	+
<i>Neurachne alopecuroidea</i>	+	+
<i>Patersonia occidentalis</i>	+	+
<i>Petrophile linearis</i>	+	
<i>Podolepis gracilis</i>	+	
<i>Pterostylis recurva</i>		+
<i>Scaevola canescens</i>	+	
<i>Scaevola repens</i> var. <i>repens</i>	+	
<i>Schoenus brevisetis</i> complex	+	
<i>Schoenus caespitosa</i>		+
<i>Schoenus curvifolius</i>	+	
<i>Scholtzia involucrata</i>	+	
<i>Stipa compressa</i>	+	
<i>Stipa pycnostachya</i>	+	
<i>Stirlingia latifolia</i>	+	
<i>Tetraria octandra</i>	+	
<i>Thysanotus sparteus</i>		+
<i>Thysanotus thyrsoideus</i>		+
<i>Trachymene pilosa</i>	+	+
<i>Tricoryne elatior</i>		+
<i>Tricostularia neesii</i>	+	
* <i>Ursinia anthemoides</i>		+
<i>Verticordia densiflora</i>	+	

*Introduced

STATUS OF FLORA TAXA (Atkins 2005)

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 pursuant to the *Wildlife Conservation Act 1950*.’

Priority 1 (P1) ‘taxa which are known from one or a few populations which are under threat.’

Priority 2 (P2) ‘taxa which are known from one or a few populations, at least some of which are not believed to be under immediate threat.’

Priority 3 (P3) ‘taxa which are known from several populations, at least some of which are not believed to be under immediate threat.’

Priority 4 (P4) ‘taxa which are considered to have been adequately surveyed and which, whilst being rare, are not currently threatened by any identifiable factors.’

GLOSSARY

Alluvial - sediments deposited by running water

Colluvial - loose and incoherent soil deposits, usually at the foot of a slope or cliff and brought down by gravity

Fluviatile - found in or near rivers

