INTERIM RECOVERY PLAN NO. 58

EASTERN SHRUBLANDS AND WOODLANDS (SWAN COASTAL PLAIN COMMUNITY 20C)

INTERIM RECOVERY PLAN

2000-2003

by

Val English and John Blyth

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Natural Heritage Trust
Helping Communities Helping Australia

Department of Conservation and Land Management

Department of Conservation and Land Management
Western Australian Threatened Species and Communities Unit
PO Box 51, Wanneroo, WA 6946

FOREWORD

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

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

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

This Interim Recovery Plan will operate from 31 January 2000 but will remain in force until withdrawn or replaced.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 three years.

The 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 January 2000.

SUMMARY

Name: Eastern shrublands and woodlands (Swan Coastal Plain community 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.

CALM Region(s): Swan

CALM District(s): Mundaring

Shire(s): Swan

Recovery Team: To be established. The team will be chaired by a CALM Swan Region representative. The Recovery Team will report annually to CALM's Corporate Executive.

Current status: Assessed 18 July 1996 as Critically Endangered

Habitat requirements: The plant community mainly occurs on soils mapped as the Forrestfield Unit of the Ridge Hill Shelf (Churchward and McArthur 1980). The most northerly occurrence is on the junction of this unit and the Guildford clays.

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 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.* 1994 and DEP 1996) as well as biological processes, taking account of natural change of the community over time.
- Improvement in terms of reduction of numbers of exotic species and of other threatening processes as defined in this document.

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

Recovery Actions:

1. Establish Recovery Team	14. Implement weed control
2. Liaise with landholders, management bodies and land managers	15. Fence Occurrence 1
3. Clarify and monitor boundaries	16. Fence Occurrence 2 (timing dependent on transfer of care,

	control and management from the Department of Defence to CALM)
4. Determine management requirements of other occurrences	17. Develop Management Plan for Occurrence 1
5. Disseminate information	18. Amalgamate VCL (Swan Locations 11314 and 11764), and remnant in reserve 6955 if necessary, with reserve 23953,
6. Install markers	19. Alter purpose of reserve 23953
7. Monitor flora	20. Implement drainage strategy (for Occurrence 1)
8. Develop Fire Management Strategy	21. Control rabbits
9. Implement Fire Management Strategy	22. Transfer care control and management of threatened communities in Bushmead Rifle Range to NPNCA
10. Implement dieback hygiene	23. Replanting / rehabilitation
11. Monitor dieback	24. Conduct research
12. Implement dieback treatments	25. Report on management strategies
13. Monitor weed populations	26. Negotiate to transfer reserve 23953 to NPNCA if necessary

1. BACKGROUND

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

The plant community 'eastern shrublands and woodlands (Swan Coastal Plain community 20c; Gibson *et al.* 1994)' hereafter described as 'eastern shrublands and woodlands') occurs on the eastern 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 only two remaining occurrences of the community listed on CALM's threatened ecological communities database. One of these is in an area known as Talbot Road bushland in Stratton (Occurrence 1 - refer Table 1), the other at Bushmead Rifle Range in Helena Valley (Occurrence 2). The occurrence in the Bushmead Rifle Range was located in the System 6 Update study (DEP 1996). This occurred during the integrated process of updating both the 'System 6' Conservation Through Reserves System Recommendations and the Ministry for Planning Urban Bushland Strategic Plan, resulting in Perth's Bushplan (State of Western Australia 1998). An additional occurrence of the community was found during this process and is listed in Perth's Bushplan (State of Western Australia 1998). It is yet to be incorporated into the threatened ecological communities database.

Although statistical analysis of plot data indicates the two sites on the threatened ecological communities database are the same community, there are some significant differences in structure and composition of the two sites (Gibson *et al.* 1994; DEP 1996). These differences may be due to natural variation in the community (B. Keighery[1] 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 'eastern shrublands and woodlands' is located 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 kilometre 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 contains the plant community known as 'eastern shrublands and woodlands'.

Only about 106 hectares of the community remain. About 38 hectares is in the care, control and management of the Commonwealth of Australia for the use and requirements of the Army, about 40 hectares is managed

[1] Bronwen Keighery, Department of Environmental Protection, 141 St Georges Terrace, Perth, 6000

by the Shire of Swan, approximately 17 hectares is under the care, control and management of the Cemeteries Board and about 11 hectares is unallocated Crown land.

Areas of very high conservation value such as Talbot Road bushland are usually recommended for placing with the National Parks and Nature Conservation Authority (NPNCA) for the purpose of Conservation of Flora and Fauna. However, given the Shire of Swan's commitment and interest in the area, it should be possible to protect the conservation values of threatened ecological communities and threatened flora in the bushland area initially through the mechanisms of this Interim Recovery Plan. If this is not possible, discussion should commence towards transferring the care, control and maintenance of Talbot Road bushland to the NPNCA.

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

Table 1: Extent and location of occurrences

Occurrence Number	Location	Management body	Estimated area
1	reserve 23953, Talbot Road, Stratton	Shire of Swan	40 hectares
	Unallocated Crown land - Swan Location 11314 (adjacent to the south west of reserve 23953)	Unallocated	11 hectares
	reserve 6955, Shire of Swan	Cemeteries Board	17 hectares
2	Part Lot 9 on Diagram 4347, Helena Location 20a,. Bushmead Rifle Range, Helena Valley	Commonwealth of Australia (for the use of the Army)	38 hectares

1.2 Description of Occurrences

Both occurrences of the 'eastern shrublands and woodlands are in the Shire of Swan.

Occurrence 1 of the community 'eastern shrublands and woodlands' 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, to the 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 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 or the Shire of Swan. Swan Location 11764, another area of unallocated Crown land, occurs adjacent to the south eastern side of the cemetery reserve. 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' managed by the Shire of Swan. The Shire has developed a management plan for this reserve (Safstrom and Taman 1999), the boundaries of which are mostly fenced. The site is used by walkers and for other passive recreation. This reserve has been burnt a number of times in recent years. 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* sp. Gravel has been extracted from the south-eastern corner of reserve 23953.

The Priority three taxa (refer to Glossary for definitions) *Isopogon drummondii* and *Lambertia multiflora* var. *darlingensis* ms and the priority four taxon *Thysanotus glaucus*is occur in the 'eastern shrublands and woodlands' at Talbot Road (Gibson *et al.* 1994). *Hakea myrtoides* (Priority three) and *Synaphea acutiloba* (also Priority three) are recorded from the critically endangered Marri community that also occurs within the Talbot Road bushland. 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 sizeable flocks of sheep (Ecologia Environmental Consultants 1991), which has caused weed invasion and may have caused 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. Until recently, when the conservation significance of the area was noted (Ecologia Environmental Consultants 1991) the Bushmead site was used as a training area for the Army's Transport Squadron. 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 eastern shrublands and woodlands covers about 38 hectares of a total of 296.5 hectares 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 endangered (English and Blyth 1997). A 120 ha area within the 296 hectare Bushmead Rifle Range, containing communities 20c and 20a, is on the Register of the National Estate (Australian Heritage Commission 1997).

The Bushmead Rifle Range is owned by the Commonwealth for the use of the Australian Army. However, much of the land is no longer required for their use and the Ministry for Planning is negotiating to acquire the area. CALM is involved in discussions with the Ministry for Planning towards having some part of the rifle range reserved for conservation, including the areas containing the threatened communities 20c and 20a.

1.3 Biology and ecology

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). Both 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 fluviatile 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.

The composition of 'eastern shrublands and woodlands' 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 in better general condition and more diverse than that at Bushmead, but cover of weeds in much of 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.

Species richness is high in the Occurrence at Talbot Road, with an average of 64 species occurring in nine plots of 100 m^2 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).

1.4 Hydrology

Drains from urbanised areas to the east flow into the Talbot Road bushland, and result in increased surface flow through the reserve in unconfined drains. Dieback 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 need to be consulted if any modifications to the drainage or creekline are planned.

1.5 Threatening processes

1.5.1 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 'eastern shrublands and woodlands' community occurs. The type is also likely to have been regionally rare prior to any clearing (Gibson *et al.* 1994). Hence, little remains of this community.

The Talbot Road bushland contains several separate land titles, including a recreation reserve, two areas of unallocated Crown land and a Cemetery reserve. None of these titles necessarily provide for protection of conservation values, although the Shire of Swan has stated a commitment to protecting the nature conservation values of recreation reserve 23593 (G. MacKinnon,[2] personal communication). A Management

[2] Grant MacKinnon, Shire of Swan, Morrison Road, Midland 6056

Plan (Safstrom and Taman 1999) is now being applied to the entire Talbot Road bushland area as described in Section 1.2.

The south-eastern portion of reserve 23953 was historically cleared and used for gravel extraction. Bushland adjacent to reserve 23593 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 their purposes 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 in the care, control and management of the Commonwealth of Australia. However, as mentioned above, CALM is negotiating to have the vesting of a significant proportion of the area, including the part covered by this critically endangered community, placed in the National Parks and Nature Conservation Authority as a conservation area.

Altered fire regimes

Mediterranean ecosystems would be adapted to fire and indeed may require a particular fire regime to assist regeneration (Gill, *et al. 19*81). 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 both occurrences 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. MacKinnon, personal communication) is likely to have favoured plants that propagate by resprouting, and weeds.

All disturbance in remnants results in increasing weed invasion, particularly where remnants are small. Therefore, fire frequency should be minimised unless future studies indicate the need to increase it for some particular reason. 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 original native species in the herb layer. The fire frequency in Talbot Road bushland has been very high recently and may well be impacting the community in terms of structure, composition and level of weed invasion. The floristics of the site need to be monitored 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 would be vulnerable to weed invasion following any disturbance. Current levels of weeds in Occurrences 1 and 2 are still quite low, however.

There are tracks through both 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. 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 (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
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.

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 causing weed invasion.

Rabbits are impacting parts of Talbot Road bushland, 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 should be undertaken in this bushland area, taking care not to impact local fauna.

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, may require specific management.

The community in Bushmead Rifle Range also may 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 should be mapped in Bushmead Rifle Range to help guide future management such as rehabilitation, treatment of priority areas with phosphite which is used to control dieback, and closure of specific tracks where vehicle or foot access may spread or amplify dieback impact.

Hydrological changes

Water from urban areas to the east of Talbot Road bushland is channelled 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.

The pollution of the surface waters with animal droppings or fertilisers would increase nutrient levels and, hence, favour 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 critically endangered community and other means of channelling water should be considered.

Note. All of the occurrences within the area considered under Perth's Bushplan that contain the community are included in the Perth's Bushplan document (State of Western Australia 1998). This document provides that any proposals likely to affect occurrences of threatened ecological communities will be dealt with through the Bushplan process, coordinated between the Department of Environmental Protection, Ministry for Planning, CALM and the Water and Rivers Commision. The aim of the Bushplan process is to protect listed sites (State of Western Australia 1998).

1.6 Conservation status

The community meets criterion B (ii) as follows, for critically endangered (from English and Blyth 1997):

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.

1.7 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 'eastern shrublands and woodlands' and reduce the level of threat with the aim of downgrading it from Critically Endangered to Endangered.

2.2.1 Criteria for success

1. An increase in the area, and number of occurrences, of this community under conservation management.

2. Maintenance in terms of diversity and basic composition of native species (as described in Gibson *et al.* 1994 and DEP 1996) as well as hydrological and biological processes, taking account of natural change of the community over time.

3. Improvement in terms of reduction of numbers of exotic species (as described in Gibson *et al.* 1994 and DEP 1996) and of other threatening processes as defined above.

2.2.2 Criterion 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, in cooperation with the Western Australian Threatened Species and Communities Unit (WATSCU) and the Recovery Team share the primary responsibility for securing funds for 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.

3.1 Establish a Recovery Team

Responsibility: CALM (Western Australian Threatened Species and Communities Unit (WATSCU))
Cost: $0 (the small costs of attending meetings should be met by Recovery Team members)-
Completion date: Year 1

3.2 Liaise with current management bodies, owners, land managers and other interested groups to implement recommendations held in this IRP

Both of the occurrences of the community are currently managed by authorities other than CALM, or are on unallocated Crown land. The involvement of management bodies, land managers, relevant Aboriginal and local community groups and industry in the recovery of the community wherever possible and practical is therefore essential to the recovery process.

Stakeholders include the Friends of Talbot Road bushland group who are involved in the management of the Talbot Road reserve, 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. At the time of writing this IRP the Commonwealth of Australia was the management body for the Bushmead Rifle Range.

Responsibility: CALM (Mundaring District; WATSCU)
Cost: Costs of all liaison $2,000 in 1999, $1,000 p.a. thereafter
Completion date: Ongoing.

3.3 Clarify and monitor the extent and boundaries of the community

The boundaries of the additional occurrence of the community listed in Perth's Bushplan (State of Western Australia 1998) and of any others identified in future will be determined.

Occurrences should be monitored every two years. Boundaries can be determined from current aerial photographs and minimal on site checking. This information should be added to the threatened ecological community database as recommended in English and Blyth (1997). English and Blyth (1997) also recommend the establishment of a Geographic Information System database for information on threatened ecological communities. When this is available, boundary information for occurrences of the community should be included.

The boundaries of occurrences currently on the threatened ecological communities database have been accurately mapped (Occurrence 1 by Keighery and Keighery 1993; Occurrence 2 from plot data and current aerial photographs by V. English - unpublished data).

Responsibility: CALM, (Mundaring District; WATSCU)
Cost: $450 in 1999 and 2001
Completion date: Ongoing.

3.4 Determine management requirements of any other identified occurrences

The management requirements of the additional occurrence of the community is listed in Perth's Bushplan (State of Western Australia 1998) and any others identified in future will be determined.

Responsibility: CALM, (Mundaring District; WATSCU)
Cost: Costs of all liaison included in 3.2
Completion date: Ongoing.

3.5 Disseminate information about the community

To prevent accidental destruction of the community and gain public support for its conservation, it is recommended that information about the community be provided by local CALM staff to all stakeholders including management bodies, and managers of land containing the community. This would include information from the threatened ecological community database, and maps indicating the location of the community. This action is recommended in English and Blyth (1997).

Local CALM staff should ensure regular liaison with management bodies and managers of land containing the community to ensure threatened ecological community information is up to date.

A publicity campaign utilising signs in reserves, local media, and poster displays in prominent areas should be undertaken to encourage awareness about this threatened ecological community.

Responsibility: CALM (Corporate Relations Division; Mundaring District; WATSCU)
Cost: $1,500 in Year 1, $500 in Year 2
Completion date: Ongoing

3.6 Install markers to indicate the locations of occurrences of the community alongside tracks, firebreaks and roads

CALM will mark, or encourage the management bodies to mark, roadside occurrences, and occurrences of this ecological community located on tracks or firebreaks with the same pegs used to mark threatened flora, to reduce the likelihood of accidental destruction. This action is recommended in English and Blyth (1997).

Responsibility: CALM (Mundaring District; WATSCU), in consultation with management bodies of occurrences
Cost: $500 in Year 1
Completion date: Year 1

3.7 Design and implement a flora monitoring program

Data collected should include weed levels, plant species diversity and species composition of flora.

Occurrences should be monitored two-yearly to provide information on condition. This information should be added to the threatened ecological community database as recommended in English and Blyth (1997).

Floristic plots occur in both occurrences (total of 10 plots - Gibson *et al*. 1994; DEP 1996). Sufficient data would probably be provided by detailed monitoring of one plot in the *Banksia* woodland and one in the shrubland in Occurrence 1, and the single plot in Occurrence 2, along with photographic monitoring. The latter would entail taking photographs at the monitoring plots as well as at several other plots or points in each of the three areas referred to. All native and weed species were originally recorded, but density or cover values for each species were not included in these data and would 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).

Data should be entered on a database program and unfamiliar plant species should be collected (except identified Declared Rare Flora). Following the second monitoring period, data should be analysed by the methods of Gibson *et al.* (1994) and compared as part of the full Recovery Plan (RP), if a full RP is developed.

Responsibility: CALM (Mundaring District, WATSCU)
Cost: $1,500 every second year (for monitoring a total of 3 plots in the community for field survey, specimen identification, and databasing for 1 monitoring period)
Completion date: Ongoing

3.8 Develop and Implement a Fire Management Strategy

3.8.1 Develop and implement a fire management strategy that encompasses the following (3.7.1-3.7.4) and includes an annual fire monitoring and reporting schedule

There is a need for research into the recovery of the community from fire (to be completed under Action 3.6 - flora monitoring), and to determine the implications of findings for management. This would also include developing a fire history map of each occurrence, which is updated annually. As little is known of the response of the community to fire, no planned burn should be implemented for the life of this IRP, unless results of future studies suggest it is necessary and urgent.

A Fire Management Plan has been developed for reserve 23953 by the WA Fire and Rescue Service, Shire of Swan and CALM (Appendix 2). It specifies no planned burns without consultation with CALM, 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. A similar plan should be developed for Occurrence 2, using the plan for Talbot Road Bushland as a guide. The Fire and Rescue Service, in liaison with CALM's Perth and Mundaring Districts, is developing Fire Management Plans for all remnants that contain occurrences of threatened ecological communities in their districts. Close liaison with all stakeholders is required to develop such Fire Management Plans.

Responsibility: CALM (Mundaring District) in consultation with all stakeholders
Cost: $850 for development of plan (for Occurrence 2); costs of liaison included in 3.2
Completion date: Year 1

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

Fire-breaks are maintained by Shire of Swan in Talbot Road bushland, and maintenance is specified as routine in the Fire Management Plan for the remnant. 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 should be used to maintain fire-breaks, to reduce the spread of dieback and weeds. Local CALM staff should 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 should be constructed or existing breaks upgraded around occurrences of this community on CALM managed lands (if occurrences become vested in the NPNCA) without the approval of the Director of Nature Conservation.

Responsibility: CALM (Mundaring District) in consultation with management bodies of occurrences; liaison with surrounding landholders
Cost: Cost of maintaining fire-breaks $1,000 pa; costs of liaison included in 3.2
Completion date: Ongoing

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

Burning at inappropriate times when fires are likely to spread to adjacent lands should be avoided.

Responsibility: CALM (Mundaring District); liaison with surrounding landholders
Cost: Costs of liaison included in 3.2
Completion date: Ongoing

3.8.4 Ensure fire suppression actions do not impact the community

CALM 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 the remnant that contains Occurrence 2, based on those developed for the Talbot Road Reserve.

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

A local CALM staff member should 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 (Mundaring District); in liaison with local Bush Fire Brigades and Fire and Rescue Service
Cost: Costs of preparation of guidelines and liaison included in 3.7.1 and 3.2; additional funds for District staff to attend fires in the community - $500 pa
Completion date: Ongoing

3.9 Ensure hygiene conditions

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

Standard practice should therefore be 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 on these remnants.

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

3.10 Monitor dieback and determine priority areas for dieback treatment

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 dieback front in Occurrence 1 should be monitored at least every five years in summer and flagging marking the front replaced regularly. Additional plot information (refer 3.6) would provide useful monitoring data for all sites.

Responsibility: CALM (Mundaring District) in consultation with management bodies of occurrences
Cost: $4,200 (spent on dieback survey)
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 management bodies, such a strategy should initially be implemented in the highest priority areas of Occurrence 1 and if necessary be extended to areas of the community in Bushmead Rifle Range if and when they are vested in the National Parks and Nature Conservation Authority. 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 was begun in May 1996 in another critically endangered community the 'shrublands on southern ironstones' at Busselton. This technique may also be suitable for areas of the community remote from houses in Talbot Road bushland.

If aerial spraying is adopted, the ecological community should be sprayed twice at six-week intervals with 20% phosphite at 30 litres per hectare (L/ha). Spraying should be undertaken in autumn, winter or spring and the spread of the disease then monitored (as per Action 3.9). Additional treatment should be undertaken when active dieback is again noted, or within approximately one to two years, whichever comes first (F. Bunny[3], personal communication).

Responsibility: CALM (Mundaring District, Dieback Coordination Group, CALMScience Division, WATSCU) in consultation with management bodies of occurrences
Cost: $4,100 in Year 1, $800 in Year 2
Completion date: Ongoing

3.12 Assess and monitor weed populations

Weed populations should be accurately mapped and appropriate herbicides or other method of weed control determined.

Local groups should be encouraged to participate in these surveys.

Responsibility: CALM (Mundaring District) in consultation with management bodies and managers of occurrences
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 3.6
Completion date: Ongoing

[3] Felicity Bunny, formerly CALM dieback researcher

3.13 Implement weed control, replanting and rehabilitation where necessary

Initial stages of rehabilitation should involve control of perennial weeds and their replacement with appropriate local species, where applicable. The highest priority should be controlling weeds that pose the greatest threat to the community, where possible in the early stages of invasion, eg *Watsonia* and invasive perennial grasses such as veldt grass (*Erharta calycina*). 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 should be identified from Plot data for each occurrence in Gibson *et al.* (1994) and DEP (1996), and from monitoring data collected under 3.6. These should then be propagated from stock from the same reserve to preserve local provenance.

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.

Talbot Road bushland is used for illegal rubbish dumping and Shire of Swan and Friends of Talbot Road reserve group are constantly removing refuse from reserve 23953.

The issues of weed control, rehabilitation and rubbish collection are considered in detail for Occurrence 1 by Safstrom and Taman (1999).

Responsibility: CALM (Mundaring District) in liaison with management bodies of occurrences
Cost: Occurrence 1: $21,600 in 1999, $20,000 in 2000, and $19,800 for weed control (whole remnant) (costs for weed control Occurrence 2 $500 pa.); costs of rehabilitation $2,600 in 2000; $7,500 in 2001
Completion date: Ongoing

3.14 Ensure fences are constructed where necessary to protect the community

Appropriate fencing for both occurrences would permit authorised vehicle access for operational purposes, allow foot access and protect rehabilitation areas in high usage zones where necessary.

Occurrence 1 is suffering some degradation from the impact of recreational use such as illegal use by trail bikes and four wheel drive vehicles, and from littering, although it is partly fenced. The fencing of much of the remaining boundary of reserve 23953 at Talbot Road (approximately 150 m) will be completed under conditions of subdivision for surrounding developments (G. MacKinnon, personal communication). The remnant in this reserve is contiguous with partially fenced remnant vegetation in two areas of unallocated Crown land and a cemetery reserve, to the south west. Fencing has been completed around the perimeter of this entire remnant except an approximately 280 m strip beside the unallocated Crown land along Myles Road to the north of the cemetery (G. MacKinnon, personal communication).

In the event of successful negotiation by CALM to secure tenure of the remnant that contains the community at Bushmead, fencing may need to be constructed to restrict inappropriate access to the site.

The perimeter of the Bushmead Rifle Range is already fenced, but the area is likely to be split into a number of lots managed by different authorities. Appropriate locations for fences to protect the 'eastern shrublands and woodlands' should be determined once the cadastral boundaries are determined.

Responsibility: CALM (Mundaring District), Shire of Swan - Occurrence 1. CALM (Mundaring District) responsible for fencing the portion of Bushmead Rifle Range that becomes vested in the National Parks and Nature Conservation Authority (NPNCA)

Cost: Costs of fencing remainder of Talbot Road bushland $5,800 in 1999 plus $5,100 pa for maintenance. Cost of fencing Occurrence 2 $4,000 plus $3,000 pa for maintenance. Costs of liaison included in 3.2

Completion date: Occurrence 1 ongoing; Occurrence 2 - to be determined by timing of reservation of remnant containing occurrence

3.15 Design and conduct research

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

1. The impact of weeds on the community.
2. The effectiveness of different herbicide treatments.
3. The role of disturbance in regeneration of the community.
4. The recovery of the community following wild fires (this will be considered in the Fire Management Plan developed under 3.7).
5. The development of a monitoring system. Protocols will be developed based on recommendations held in English and Blyth (1997).
6. 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.

Responsibility: CALM (CALMScience Division; Mundaring District; WATSCU)

Cost: Recovery Team to determine costs and likely funds available through other sources and to recommend a research program and sources of funds to CALM

Completion date: No date set

3.16 Report on success of management strategies

Reporting should be part of annual reports prepared by the Recovery Team for CALM's Corporate Executive. A final report would be presented as part of or complementary to the full recovery plan for the community, if a full recovery plan is necessary.

Responsibility: CALM (Mundaring District; WATSCU); Recovery Team

Cost: $2,000

Completion date: Year 3

Specific Management Actions - Talbot Road Bushland - Occurrence 1

Note: The same recommendations for Talbot Road bushland are in the Interim Recovery Plan for the other critically endangered community that occurs in the area - the '*Eucalyptus calophylla - Xanthorrhoea preissii* woodlands and shrublands'.

3.17 Develop management plan

A detailed Management Plan is being completed for Talbot Road bushland (Safstrom and Taman 1999).

Responsibility: CALM (Mundaring District); liaison with Shire of Swan and Metropolitan Cemeteries Board

Cost: $20,000 to develop plans; costs of liaison included as part of 3.2 Occurrence 2 – timing and cost to be determined by timing of transfer of care, control and management of remnant

Completion date: Year 1

3.18 Amalgamate unallocated Crown land with reserve 23953

The tenure of all land parcels in Talbot Road bushland is considered in Perth's Bushplan (State of Western Australia 1998) and in the detailed management plan (Safstrom and Taman 1999).

Remnant vegetation in Talbot Road bushland should be managed for conservation. Towards that end, negotiations to have Swan Locations 11314 and 11764 (northern and southern areas of unallocated Crown land within the remnant that also contains reserve 23953) amalgamated with reserve 23953 should be continued.

Responsibility: CALM (Mundaring District; Land Acquisitions Section); Shire of Swan, DOLA
Cost: Costs of liaison included in 3.2
Completion date: Year 2

3.19 Negotiate to transfer care, control and maintenance of bushland remnant in reserve 6955 to Shire of Swan if necessary

In the event of an unsatisfactory outcome for reserve 6955 from recommendations 3.16 and 3.17 in this IRP, and in Perth's Bushplan (State of Western Australia 1998), CALM will liaise with relevant agencies to seek to locate land suitable for the use and requirements of the Metropolitan Cemeteries Board. If such a site is found, CALM will pursue amalgamation of 'Cemeteries' reserve 6955 with reserve 23953.

Responsibility: CALM (Mundaring District; Land Administration Section); liaison with Metropolitan Cemeteries Board; Shire of Swan; and DOLA
Cost: Costs of liaison included in 3.2
Completion date: Year 2

3.20 Alter the purpose of reserve 23953 to 'Conservation and Recreation'

Following implementation of Recommendations 3.17 (and 3.18 if achieved), negotiate to have the purpose of amalgamated reserve 23953 altered to 'Conservation and Recreation'.

Responsibility: CALM (Mundaring District; Land Acquisitions Section); Shire of Swan, DOLA
Cost: Costs of liaison included in 3.2
Completion date: Year 2

3.21 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 (J. Carter, V. English personal observation). A strategy to confine or divert the drainage waters into the Blackadder Creek 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 Nyoongar Aboriginal people have cultural links to Blackadder Creek that runs through the remnant and should be consulted with regard to any changes to drainage in the Talbot Road bushland.

Responsibility: CALM (Mundaring District); Shire of Swan; Water Corporation in consultation with appropriate Aboriginal groups
Cost: Costs of liaison included in 3.2; diversion of drainage $600 in 2000; $24,700 in 2001 (from Safstrom and Taman 1999)
Completion date: Year 2

3.22 Design and implement a rabbit control program for Talbot Road bushland

A rabbit control program should be implemented in the eastern portion of Talbot Road bushland where recent fires have disturbed the understorey vegetation. Care should be taken not to impact local fauna.

Levels of rabbit control with baiting will depend on the combined effects of the two viruses, Myxomatosis and Calicivirus, the last of which occurs in a patchy manner in the metropolitan area. Although these two viruses provide excellent results in some areas they must still be supported by other control methods. Baiting for rabbits using Pindone is likely to be the most viable option, as use of 1080 may result in poisoning of dogs and cats. Pindone can only be used where macropods are not present, however. Baiting is generally conducted in summer and repeated each year if rabbits reappear in future years (T. Black[4] personal communication).

Responsibility: CALM (Mundaring District); Shire of Swan; Agriculture Western Australia
Cost: $1,300 pa for baiting of Talbot Road bushland using Pindone
Completion date: Ongoing

3.23 Negotiate to transfer the care, control and management of reserve 23953 if necessary

If effective management for conservation of Occurrence 1 seems unlikely to result from recommendations 3.16 - 3.21 held in this IRP, CALM should negotiate to have (the amalgamated) reserve 23953 declared Class A for the purpose of 'Conservation of Flora and Fauna' and have it vested in the National Parks and Nature Conservation Authority.

Responsibility: CALM (Mundaring District; Land Administration Section); DOLA
Cost: Costs of liaison included as part of 3.2
Completion date: To be determined if necessary

Specific Management Actions - Bushmead Rifle Range - Occurrence 2

3.24 Place management of threatened ecological communities and buffers in the NPNCA

CALM will continue to negotiate to have the threatened ecological communities and suitable buffer areas within Bushmead Rifle Range declared a Class A reserve for the purpose of 'Conservation of Flora and Fauna' vested in the National Parks and Nature Conservation Authority (NPNCA).

Negotiations are taking place between the Ministry for Planning and the Commonwealth to have the ownership of the whole rifle range transferred to the WA Planning Commission. CALM would then seek to have portions of the rifle range area vested with the National Parks and Nature Conservation Authority. The endangered community '*Banksia attenuata* over species rich dense shrublands' as described by Gibson *et al.* (1994) also occurs in the rifle range area. This community and the remainder of the remnant that provides a buffer for it and the remnant containing and buffering the 'eastern shrublands and woodlands' should be acquired as conservation reserve.

Responsibility: CALM (Land Administration Section); liaison with Ministry for Planning, Commonwealth of Australia and DOLA
Cost: Costs of liaison included in 3.2
Completion date: Year 2

[4] Terry Black, Agriculture Western Australia, Baron-Hay Court, South Perth, 6151

Table 2: Summary of recovery actions

Recovery Action	Occurrences	Responsibility	Completion date
Establish Recovery Team	All	CALM (WATSCU)	Year 1
Liaise with landholders, management bodies and managers	All	CALM (Mundaring District, WATSCU)	Ongoing
Clarify and monitor boundaries	All	CALM (Mundaring District, WATSCU)	Ongoing
Determine management requirements of other occurrences	All	CALM, (Mundaring District; WATSCU)	Ongoing
Disseminate information	All	CALM (Corporate Relations Division, Mundaring District, WATSCU)	Ongoing
Install markers	All	CALM (Mundaring District, WATSCU)	Year 2
Monitor flora	All	CALM (Mundaring District, WATSCU)	Ongoing
Develop Fire Management Strategy	2	CALM (Mundaring District, WATSCU) in consultation with all stakeholders	Occurrence 1 has existing Plan. Plan for Occurrence 2 to be completed December 1999.
Implement fire management strategy	All	CALM (Mundaring District) in liaison with Bush Fire Brigades, Fire and Rescue Service	Ongoing
Implement dieback hygiene	All	All personnel operating machinery in the occurrences	Ongoing
Monitor dieback	All	CALM (Mundaring District)	Ongoing
Implement dieback treatments	1	CALM (Mundaring District)	Ongoing
Assess and monitor weed populations	All	CALM (Mundaring District)	Ongoing
Implement weed control	All	CALM (Mundaring District)	Ongoing
Fence Occurrence 1	1	CALM (Mundaring District), Shire of Swan	Maintenance ongoing
Fence Occurrence 2	2	CALM (Mundaring District)	To be determined
Develop Management Plan	1	CALM (Mundaring, District); management bodies	Year 1
Amalgamate VCL (Swan Locations 11314 and 11764), and remnant in reserve 6955 if necessary, with reserve 23953	1	CALM (Mundaring District, Land Acquisitions Section), DOLA, Shire of Swan, Cemeteries Board	Year 2
Alter purpose of reserve 23953	1	CALM (Mundaring District), DOLA, Shire of Swan	Year 2
Implement drainage strategy	1	CALM (Mundaring District), Shire of Swan, relevant Aboriginal Groups, WRC	Year 2
Control rabbits	1	CALM (Mundaring District), Shire of Swan, Agriculture WA	Ongoing
Place care, control and management of threatened communities with NPNCA	2	CALM (Mundaring District, Land Acquisitions Section); liaison with Commonwealth of Australia, DOLA, MFP	Year 2
Replant / rehabilitate	1	CALM (Mundaring District), Shire of Swan	Ongoing
Conduct research (cost to be determined)	All	CALM (SID, Mundaring District, WATSCU)	No date set
Report on management strategies	All	CALM (Mundaring District, WATSCU), Recovery Team	Year 3
Negotiate to transfer reserve 23953 to NPNCA	1	CALM (Mundaring District, Land Acquisitions Section)	As required

Table 3: Summary of costs for each recovery action

Recovery Action	Year 1	Year 2	Year 3
Establish Recovery Team	-		
Liaise with landholders, management bodies and land managers	2,000	1,000	1,000
Clarify and monitor boundaries	450		450
Determine management requirements of other occurrences	-		
Disseminate information	1,500	500	
Install markers	500		
Monitor flora	1,500		1,500
Develop Fire Management Strategy	850		
Implement Fire Management Strategy,	1,500	1,500	1,500
Implement dieback hygiene	-	-	-
Monitor dieback	4,200		
Implement dieback treatments	4,100		800
Monitor weed populations	1,000		1,000
Implement weed control	22,100	20,500	20,300
Fence Occurrence 1	5,800	5,100	5,100
Fence Occurrence 2 (timing dependent on revesting)		4,000	3,000
Develop Management Plan for Occurrence 1	20,000		
Amalgamate VCL (Swan Locations 11314 and 11764), and remnant in reserve 6955 if necessary, with reserve 23953,	-		
Alter purpose of reserve 23953	-		
Implement drainage strategy (for Occurrence 1)		600	24,700
Control rabbits	1,300	1,300	1,300
Vest threatened communities in Bushmead Rifle Range in NPNCA	-		
Replant / rehabilitate		2,600	7,500
Conduct research	To be determined		
Report on management strategies	-		2,000
Negotiate to transfer reserve 23953 to NPNCA	-		
Total	**66,800**	**37,100**	**70,150**

Summary of costs over three years

Total $174,050

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CALM Swan Region
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APPENDIX 1

Plant taxa that occurred in at least 50% of plots in the community 'eastern shrublands and woodlands' 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	Status
	Acacia auronitens	+		
	Acacia sessilis	+		
	Acacia willdenowiana	+		
	Adenanthos cygnorum		+	
	Allocasuarina fraseriana		+	
	Allocasuarina humilis	+		
	Amphipogon turbinatus	+		
	Anigozanthus humilis		+	
	Anigozanthus manglesii	+		
	Arnocrinum preissii	+		
	Astroloma stromarrhena		+	
	Banksia attenuata		+	
	Banksia menziesii		+	
	Bossiaea eriocarpa	+		
*	*Briza maxima*	+		
	Burchardia umbellata	+	+	
	Caladenia flava		+	
	Calytrix angulata	+		
	Caustis dioica		+	
	Chamaescilla corymbosa	+		
	Conospermum stoechadis	+		
	Conostylis aculeata	+		
	Conostylis aurea	+	+	
	Conostylis juncea		+	
	Conostylis setosa		+	
	Dasypogon bromeliifolius	+	+	
	Dasypogon obliquifolius		+	
	Drosera glandulifera	+		
	Drosera stolonifera	+	+	
	Dryandra nivea	+		
	Eremaea asterocarpa subsp. *asterocarpa*	+		
	Eriostemon spicatus	+		
*	*Gladiolus caryophyllaceus*	+	+	
	Gompholobium tomentosum	+		
	Haemodorum laxum	+		
	Hibbertia hypericoides	+		
	Hibbertia huegelii		+	
	Hybanthus calycinus	+		
	Hypolaena exsulca	+		
*	*Hypochaeris glabra*	+		
	Isopogon drummondii	+		Priority 3
	Isotropis cuneifolia	+		
	Jacksonia densiflora / floribunda complex	+		
	Jacksonia sternbergiana	+		
	Johnsonia pubescens		+	
	Lambertia multiflora var. *darlingensis* ms	+		Priority 3
	Laxmannia sessiliflora subsp. *australis*	+		
	Lepidosperma exsul		+	

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

Note: status is derived from CALM 1998 (see Glossary)

* - Introduced species

APPENDIX 2

Fire Management Plan for Talbot Road Reserve

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

DEFINITIONS OF FLORA STATUS, (FROM CALM 1998)

Priority 2 '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 'taxa which are known from several populations, at least some of which are not believed to be under immediate threat.'