INTERIM RECOVERY PLAN NO. 340

Callitris preissii (or *Melaleuca lanceolata*) forests and woodlands

(Swan Coastal Plain community type 30a – Gibson *et al*. 1994)

INTERIM RECOVERY PLAN 2014-2019

Department of Parks and Wildlife

May 2014

Foreword

Interim Recovery Plans (IRPs) are developed within the framework laid down in Department of Parks and Wildlife (previously Department of Environment and Conservation) 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.

Department of Parks and Wildlife is committed to ensuring that threatened 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 after listing.

This interim recovery plan will operate from May 2014 but will remain in force until withdrawn or replaced. It is intended that, if the community is still listed after five years, the need for an updated plan will be evaluated.

This IRP was approved by the Director of Science and Conservation on 16 May 2014. The provision of funds identified in this interim recovery plan is dependent on budgetary and other constraints affecting the department, as well as the need to address other priorities.

Information in this IRP was accurate at December 2013.

ACKNOWLEDGMENTS

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Cover photograph by Valerie English.

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

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CITATION

This Interim Recovery Plan should be cited as:

Department of Parks and Wildlife (2014). *Callitris preissii* (or *Melaleuca lanceolata)* forests and woodlands (Swan Coastal Plain community type 30a – Gibson *et al.* 1994). Interim Recovery Plan No. 340. Department of Parks and Wildlife, Perth.

SUMMARY

Name: *Callitris preissii* (or *Melaleuca lanceolata*) forests and woodlands, Swan Coastal Plain.

Description: A woodland and forest community located on calcareous sandy soils of the Quindalup Dunes between Trigg and Point Peron and on the Swan River in Peppermint Grove. The community is also present on Garden Island and Rottnest Island. Typical and common native taxa in the community are: *Callitris preissii, Melaleuca lanceolata, Spyridium globulosum, Acanthocarpus preissii, Rhagodia baccata, Austrostipa flavescens* and *Trachymene pilosa* (Gibson *et al.* 1994). The introduced herbs *Galium murale* (small bedstraw), *Asparagus asparagoides* (bridal creeper) and *Trachyandra divaricata* (dune onion weed) are common in the community.

Parks and Wildlife Regions: Swan.

Parks and Wildlife Districts: Swan Coastal.

Shires: City of Nedlands, City of Stirling, Town of Claremont, Shire of Peppermint Grove, City of Cockburn, City of Rockingham.

Conservation status: Endorsed as rank vulnerable in Western Australia, November 2001.

Habitat requirements: *Callitris preissi* (or *Melaleuca lanceolata*) dominated plant communities were historically more common along the coastline, and along the Swan River from Fremantle to Kings Park on the Swan Coastal Plain. The coastal occurrences occur on calcareous sandy soils associated with the Quindalup dunes and the Swan River occurrence is on the aeolian deposits of the Cottesloe complex - central and south. Species richness is naturally quite low in the community. There have not been any detailed groundwater studies completed for this community but it is believed that this community is at least a partially groundwater dependent ecosystem.

Important occurrences: Occurrences that provide for representation of the community across its geographic range and that can be managed for conservation and/or with conservation included in their purpose are considered critical to the survival of this community.

Affected interests: Land owners and managers of all occurrences may be affected by actions in this plan, in particular on those lands not managed by Parks and Wildlife or intended to be transferred to the department management.

Indigenous interests: The South West Aboriginal Land and Sea Council (SWALSC), an umbrella group, covers the areas considered in this plan. Appendix 2 identifies areas of the ecological community that contain sites that are known to have particular aboriginal significance. Action 2 identifies the intention to continue liaison with relevant groups, including indigenous groups.

Social and economic impacts and benefits: Where specific active recreational pursuits such as four wheel driving and motorbike riding are prevented through access control, this may be perceived as a social impact, however, such access control also helps to prevent the continued degradation of the community and maintain other social benefits.

Occurrences may be threatened by proposals to clear for various developments or from hydrological change following clearing and development of adjacent land. Implementation of actions such as seeking to protect the hydrological processes in the areas adjacent to the community may result in a perceived impact on development.

Related biodiversity impacts and benefits: Recovery actions implemented to improve the quality or security of the community are likely to improve the status of any species within the community and other associated vegetation types within managed areas of remnant vegetation. Two other TECs, and three priority ecological communities occur close to remnant vegetation containing the community. Two declared rare flora, two priority fauna taxa, and one taxon of other specially protected fauna have been identified as occurring within or adjacent to this community.

Habitat critical to survival, and important occurrences: The critical habitat for this community is the sandy soils on which the community occurs, and the fresh superficial groundwater that probably helps to sustain key dominant trees in this community, and the catchment for this groundwater.

Occurrences within Bush Forever sites, and occurrences with comparatively large intact areas of the community that are in relatively good condition outside of Bush Forever, are considered important occurrences. Occurrences that provide for representation of the community across its geographic range and that can be managed for conservation and/or with conservation included in their purpose are also considered important. Locations on Garden Island, Woodman Point, Rottnest Island and Trigg are the most extensive, and are all in Bush Forever sites in areas that are managed, in part, for conservation.

Term of plan: The plan will operate from 2014 to 2019 but will remain in force until withdrawn or replaced. It is intended that, if the ecological community is still ranked vulnerable in Western Australia after five years, the need for further recovery actions and the need for an updated recovery plan will be evaluated.

IRP Objective: To maintain or improve the overall condition of the community in the known locations and reduce the level of threat with the aim of ensuring it does not meet criteria for a higher threat rank.

Criteria for success:

- An increase in the number of occurrences of this community managed for conservation and/or with conservation included in the purpose.
- Representative areas of the community across its geographical range with condition rank maintained, or with improved condition rank (Bush Forever, Government of Western Australia (2000) scales).
- 90% or more of the aerial extent of occurrences maintained at the same condition rank, or improved (Bush Forever 2000 scales)

Criteria for failure:

- Decline in condition rank of 10% or more of the area of the community.
- Failure to achieve an increase in the area managed for conservation.

Summary of Recovery Actions

Coordinate recovery actions	Determine 'normal range' of groundwater levels and quality
Continue liaison to implement recommendations	Seek to influence land management practices to manage hydrology
Continue to monitor extent and boundaries	Fence remnants that contain the community
Encompass monitoring in adaptive management framework	Clarify the identity of additional potential occurrences
Map habitat critical to survival	Develop management guidelines
Develop and implement fire management strategy	Seek long term protection of areas of the community
Implement weed control, and replant as necessary	Report on success of management strategies

1. BACKGROUND

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

A series of occurrences of this Rottnest Island pine (*Callitris preissii*) and/or Rottnest teatree (*Melaleuca lanceolata*) dominated plant community currently occur throughout the Quindalup dunes between Trigg and Point Peron and around the Swan River in the Peppermint Grove area. It also occurs on Garden Island and Rottnest Island (Figure 1). The community was identified as rare in 1994 and may have been more common along the coast near Perth and along the Swan River between Kings Park and Fremantle. There are few historical records of its occurrence much further north than Pinnaroo or south of Point Peron.

The community was endorsed as a threatened ecological community (TEC), with a threat ranking of vulnerable by the WA Minister for Environment in November 2001.

The community was located through extensive survey of the southern Swan Coastal Plain that involved compilation and analysis of data from over 1,500 plots (Keighery and Trudgen 1992; Gibson *et al.* 1994; Government of Western Australia 2000). Forty five occurrences of this community are recorded on the Parks and Wildlife threatened ecological communities database and total about 627 ha. The largest occurrence covers about 196ha, but 35 occurrences are less than 10ha in size (refer Appendix 1 for occurrence details).

Typical and common native plant taxa in the community are: *Callitris preissii, Melaleuca lanceolata, Spyridium globulosum, Acanthocarpus preissii, Rhagodia baccata, Austrostipa flavescens* and *Trachymene pilosa* (Gibson *et al.* 1994). Introduced herbs *Galium murale, Asparagus asparagoides* and *Trachyandra divaricata* are common in the understorey. A list of taxa that commonly occur in the community is at Appendix 3.

Quadrats have been established in a suite of occurrences to provide detailed information about the floristic composition of this community and were generally established in vegetation in appropriate condition to clarify the floristic community present. Where vegetation is in poor condition it is not feasible to use quadrat data and statistical techniques to clarify the floristic community type present. *Callitris preissii* is considered, however, to be a definitive indicator of the *Callitris preissii* (or *Melaleuca lanceolata*) forests and woodlands when it is present in appropriate vegetation and coastal habitat on the southern Swan Coastal Plain.

This community contains significant populations of the dominant tree species, *Callitris preissii* and *Melaleuca lanceolata* that are uncommon on the Swan Coastal Plain. *Melaleuca lanceolata* is known from Dirk Hartog Island to the South Australian border, and all other mainland states except Northern Territory. Garden Island contains the largest populations of *Melaleuca lanceolata* that occur in intact vegetation on the Swan Coastal Plain (Keighery *et al.* 1997). The distribution of *Callitris preissii* is highly restricted in the Perth area, but populations occur across central southern parts of the state, through to Wiluna in the goldfields and extending further east. In natural populations *Callitris preissii* can occur as glaucous and non-glaucous forms that appear as shades of blue-green and darker green.

Preliminary information held in Bush Forever (Government of Western Australia 2000) indicated the presence of a sub-type of the *Callitris preissii* (or *Melaleuca lanceolata*) forests and woodland vegetation on Rottnest Island. This unit is termed S12 (supplementary): 'Rottnest Island *Melaleuca lanceolata* and/or *Callitris preissii* forests and woodlands'. Keighery *et al.* (1997) reported that *Callitris preissii* occurred in some locations of a series of floristic community types and sub-types that were later named in Bush Forever (2000); these are:

29a - 'Coastal shrublands on shallow sands',
30C2 - 'Woodlands and shrublands on Holocene dunes', and
S13 – 'Northern *Olearia axillaris – Scaevola crassifolia* shrublands'.

The analysis and reporting of floristic community types undertaken for Bush Forever was incomplete, however. In addition, vegetation on Rottnest Island, and some other areas where these types and sub-types are located, has suffered quite high level modification as a consequence of inappropriate fire regimes, clearing, and expansion of grazing by native and introduced fauna since European settlement. This is particularly notable in the quadrats that were sampled on Rottnest Island in the *Callitris preissii* community that occur in mostly natural remnant stands in sites that had a level of topographic protection from fire. Prior to European impacts it is considered that the vegetation composition in the *Callitris preissii* community on Rottnest, would have been more similar to other areas such as Garden Island. Therefore the Rottnest examples, and other areas of native vegetation that naturally contain *Callitris preissii* in appropriate habitat near Perth are considered to represent types and sub-types of the *Callitris preissii* (or *Melaleuca lanceolata*) forests and woodlands that was originally described in Gibson *et al.* (1994) (G. Keighery[1] personal communication 2013).

An additional *Callitris preissii* assemblage is known to occur on Bald Island which is located between Bremer Bay and Denmark on the south coast. This assemblage contains *Agonis flexuosa, Melaleuca lanceolata, Eucalyptus conferruminata, Trymalium floribundum* and *Chorilaena quercifolia*, and a suite of herbs that are quite different to those that occur in occurrences of the TEC on the Swan Coastal Plain (S. Comer[2] personal communication). The Bald Island location also occurs in the Esperance Plains IBRA bioregion (Interim Biogeographic Regionalisation of Australia), whereas the *Callitris preissii* (or *Melaleuca lanceolata*) forests and woodlands TEC occurs in the Swan Coastal Plain bioregion. The assemblage on Bald Island is there therefore considered to be quite floristically distinct to the *Callitris preissii* (or *Melaleuca lanceolata*) forests and woodlands TEC, although the structure of the communities is similar.

Areas of the *Callitris preissii* (or *Melaleuca lanceolata*) forests and woodlands are found on the following land tenures: approximately 112 ha in conservation reserves, 8 ha on road or railway reserves, 52 ha on other public reserves, and 454 ha on Commonwealth and/or Department of Defence land. Some of the occurrences of the community are included in Bush Forever areas (Government of Western Australia 2000; see Appendix 1). Five of the occurrences that were originally recorded in the TEC database have been cleared (MYGI05, 06, 07, 08 and 11).

Too frequent fire is a major threat to the community, and fires recently burnt through the Woodmans Point occurrences (MYWOODPT02 and WOODP01: refer Appendix 2). Clearing of land is another major threat that impacts on the community. Occurrences on land whose purpose is not primarily conservation are at greatest risk of being impacted by clearing. Mainland occurrences are very close to or surrounded by highly urbanised areas. The frequency of fires, impact of recreational users, risk of hydrological impacts, and incidence of illegal rubbish dumping are generally increased in urban areas. These factors can all lead to degradation of plant communities through increasing weed invasion and alteration of structure, species composition or loss of component taxa. Salinisation from seawater incursion can also represent a threat to the community where sites occur close to the coast and are affected by developments with potential to alter the location of the

[1] Dr Greg Keighery: Science and Conservation Division, Department of Parks and Wildlife

[2] Sarah Comer: South Coast Region, Department of Parks and Wildlife

saltwater wedge.

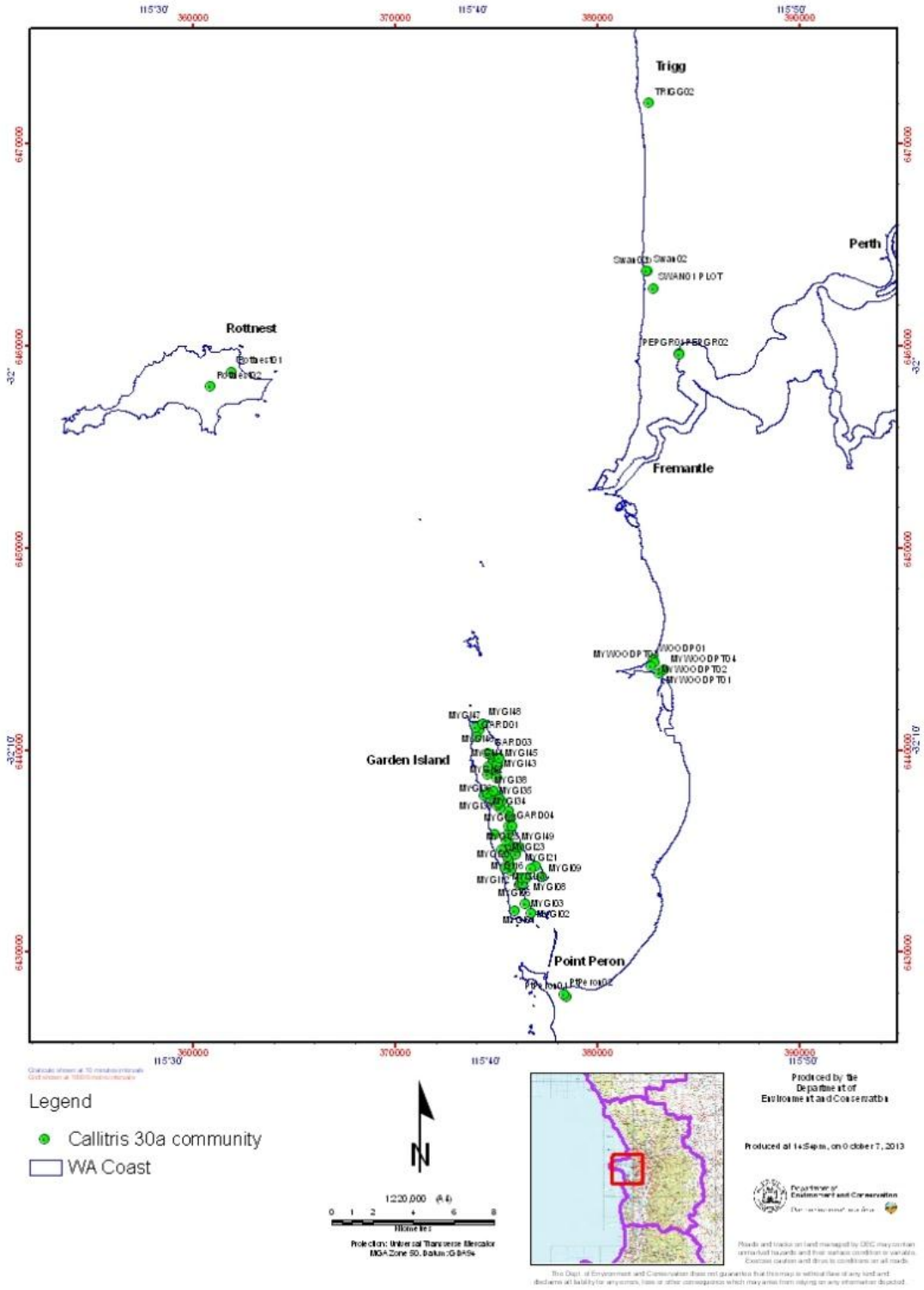

Figure 1: Location map of occurrences

1.2 Description of Occurrences

Occurrence 1 (MYWOODPT01) is bordered by Woodman Point View, Jervoise Bay Cove, Jervoise Bay and Cockburn Pleasure Boat Storage facility. The whole occurrence is within Woodman Point, Coogee/Munster Bush Forever site. The majority of the occurrence is managed by Parks and Wildlife as a Conservation Park.

Occurrence 2 (PEPGR01, 02) is located in the Shire of Peppermint Grove and bordered by The Esplanade, Keane Street and the Swan River and is within Peppermint Grove Foreshore Bush Forever site.

Occurrences 3-41 (MYGI01-48, GARD01, 03, 04, 06, 07, 09, GI-01 PLOT) occur on Garden Island, which is managed by the Australian Government Department of Defence for Naval operations. The majority of occurrences are in excellent condition due to weed control and restrictions on personnel entering bushland. The Australian Navy use the island for training, weapon storage and naval operations with many of the occurrences within or around naval infrastructure. All occurrences except 7 to 11 are in the Garden Island Bushland Forever site. A priority 3 community - type 29a as defined in Gibson *et al*. 1994 - coastal shrublands on shallow sands, is located close to occurrence 30. Weed control on arum lily (*Zantedeschia aethiopica*), ink weed (*Phytolacca octandra*) and thistles (generally *Carduus* spp.) has been recently undertaken from the northern end of Garden Island to Gilbert Point Road. General policy of fire avoidance applies for the entire island. Signs indicate where public access is permitted. About four hectares of the community was cleared recently in occurrences 12 and 25 (MYGI10 and MYGI24) for infrastructure. Garden Island occurrences are particularly important as they are generally in the best condition.

Occurrences 42 (MYWOODPT02, WOODP01) is the largest occurrence of those at Woodman Point and covers 103.7 ha. It is adjacent to Woodman Point Recreation Camp and extends along the southern coastline of Bay Owen Anchorage, through John Graham Recreation Reserve and to the east side of Coogee Beach Holiday Park. The whole occurrence except the north east corner is within the Woodman Point, Coogee/Munster Bush Forever site. Central and southern portions of the occurrence are managed by Parks and Wildlife including an area on the east side that is Conservation Park.

Occurrences 43 (MYWOODPT03) is bordered by Woodman Point Recreation Camp to the south west and south east. The occurrence is within Woodman Point, Coogee/Munster Bush Forever site and is managed by the Department of Sport and Recreation.

Occurrences 44 (PTPERON01, 02) is located south east of Peron and bordered by Safety Bay Road and Point Peron Road. The occurrence is just north west of the critically endangered thrombolites of Lake Richmond and Sedgelands in Holocene dune swales ecological communities that surround the lake. The community is within Point Peron and Adjacent Bushland, Peron/Shoalwater Bay Bush Forever site and is managed by Parks and Wildlife. Current developments that have been approved will result in clearing, and potentially hydrological impacts to this occurrence.

Occurrence 45 (MYWOODP04) occurs around Cockburn Pleasure Boat Storage facility with Jervoise Bay Cove, O'Kane Court and Cockburn Road partly bordering the occurrence. The whole occurrence is within Woodman Point, Coogee/Munster Bush Forever site. The occurrence is managed by the Department of Transport and Department of Regional Development and Lands. A major proportion of the occurrence is moderately degraded with many off road vehicles using the south eastern portion for recreation. Hydrological changes associated with a drain through the occurrence have apparently caused shrub deaths. The density of *Callitris preissii* is very low in this occurrence.

Occurrence 46 (ROTTNEST01) occurs on the eastern side of Rottnest Island east of Pearse Lakes and north of Government Lake. Geordie Bay Road borders to the south, Brand Way is on the eastern side and Rottnest accommodation occurs to the north and north east. Priority 1 communities (Microbialites and microbial mats of coastal hypersaline lakes, Rottnest) in Government House, Hershel and Garden Lakes occurs very close to this occurrence. The area is managed by the Rottnest Island Authority.

Occurrence 47 (ROTTNEST02) is located in the centre of Rottnest Island. Serpentine Lake borders the north of the occurrence with cleared bushland and unsealed tracks occur to the west, east and south. A priority 1 community (Microbialites and microbial mats of coastal hypersaline lakes, Rottnest lakes) in Serpentine Lake occurs on the boundary of this occurrence.

Occurrence 48 (TRIGG02) is the southern part of the Trigg Bushland that occurs north of Scarborough's residential area. West Coast Highway partly borders the occurrence to the west and Elliot Road borders to the east. The whole occurrence is within Trigg Bushland and Adjacent Coastal Reserve, Trigg/Scarborough Bush Forever site which also contains the priority 3 community 'Acacia shrublands on taller dunes' (community type 29b as described in Gibson *et al.* 1994). The site is managed by the City of Stirling for conservation.

Occurrence 49 and 50 (SWAN01 PLOT, SWAN02, 2b) are located in Campbell Barracks Swanbourne. The Department of Defence manage these occurrences that are located within Swanbourne Bushland, Swanbourne/City Beach Bush Forever site.

Dirt bikes and four wheeled (wheel) motorbikes are used on the sand dunes in occurrence 50.

Data on all occurrences of this community are recorded on the Parks and Wildlife corporate threatened ecological community database.

1.3 Habitat characteristics

This community occurs on calcareous sandy soils of the Quindalup Dunes near the coast. A number of plant taxa that occur in the community are typically associated with these calcareous sandy soils. These include *Callitris preissii*, *Melaleuca lanceolata, Spyridium globulosum, Acanthocarpus preissii* and *Rhagodia baccata*. The Peppermint Grove occurrences are located on the Aeolian deposits of the Cottesloe complex - central and south.

Plant taxa that commonly occur in the community are listed at Appendix 3. The mean species richness for seven plots in the community surveyed by Gibson *et al.* (1994) was 21.1 species in 100 square metres. An average of 6.3 weed species was recorded per plot in the Gibson *et al.* (1994) study. This community typically has a dense overstorey and low species richness.

Callitris forests and woodlands are believed to be at least partially groundwater dependent ecosystems, with the large dominant trees in this community – *Callitris preissii* and *Melaleuca lanceolata* likely to access fresh groundwater.

Critical habitat

The critical habitat for the *Callitris preissii* (or *Melaleuca lanceolata)* forests and woodlands includes the dunes and swale habitat on which they occur, the fresh superficial groundwater that is likely to provide water to the trees in the community, and the catchment for this groundwater.

The critical habitat for this community is therefore defined as:

- the area of occupancy of the known occurrences, and
- the catchment for the groundwater on which the community is believed likely to depend.

1.4 Threatening processes

Clearing

Historically, *Callitris* forests were cut for timber and firewood (Pryde 2007) with clearing for ongoing urban sprawl a more recent process that may have further reduced the community's extent. The *Callitris* community would have been more common along the coastline, but only relatively small occurrences in Trigg, Woodman Point and Point Peron now remain as a consequence of historical clearing and following too frequent fires

since European settlement. Keighery *et al*. (1997) indicate that forests and woodlands of *Callitris preissii* were more locally extensive in Peppermint Grove, Kings Park, and Mullalloo, but that it is unlikely that they were the dominant forests of Perth coastal areas prior to European settlement, or prior to Aboriginal burning practices. Keighery *et al*. (1997) also note that a general feature of current coastal reserves is a lack of large areas in which natural ecological processes would be expected to continue. This highlights the particular importance of the largest intact areas of *Callitris preissii* (or *Melaleuca lanceolata*) forests and woodlands, that occur on Garden Island.

An approved marina development at Point Peron will involve clearing of areas of the community and could potentially result in hydrological impacts to the remaining area of the community at that location (EPA 2013). Recent expansion of Department of Defence infrastructure at Garden Island has resulted in clearing of several hectares of the community and further clearing is planned for this purpose.

Altered fire regimes

Mediterranean ecosystems are usually fire responsive and may require a particular fire regime to assist regeneration (Abbot and Burrows 2003). If an appropriate fire frequency 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 senesce and be unable to regenerate. Therefore, bushfires or prescribed burns must occur at appropriate intervals, and possibly at the appropriate season and intensity, to sustain the integrity of plant communities.

Too frequent fire can increase the risk of invasive weeds establishing within small bushland remnants such as this community (Abbot and Burrows 2003). It is likely that the burning regime in the remnants containing the community has been modified to more frequent fires, especially hot burns, since European settlement.

The risk of fire is generally increased by the presence of grassy weeds in the understorey, as they are likely to be more flammable than many of the original native species in the herb layer. Many of the occurrences have not been burnt recently. Fire regime is a major consideration in management plans that have been developed for bushland that contains TECs (eg Woodman Point Regional Park Management Plan, Department of Environment and Conservation 2010).

Burrows (2008) notes that there is no single optimum fire regime that will meet all management objectives, but that there are fire regimes that can be applied based on available evidence. Burrows (2008) recommended fire regimes based on vital attributes, regimes that provide for diversity of frequency, season and intensity, and provide habitat diversity, and a fine-grain mosaic of habitats. Burrows suggested that if these fire regimes are implemented in an adaptive management framework, they provide good data and can lead to better fire management.

The juvenile period of many species that occur in the community is listed in Appendix 3. Although the juvenile periods of many taxa are not known, the data included in Appendix 3 can be used as a guide. Burrows *et al.* (2008) recommended a minimum period between fires that are lethal to fire-sensitive plants (obligate seeders with long juvenile periods) of at least twice the juvenile period of the slowest maturing species. That is, the juvenile period of plant taxa that are killed by fire and only reproduce from seed can be used as a guide to determine minimum inter-fire intervals. In fire sensitive habitats, this may be increased to 3-4 times the juvenile period for fire sensitive species (Barrett *et al.* 2009).

The genus *Callitris* is particularly sensitive to fire and may only occur where the previous fire frequency has been relatively infrequent such as where vegetation has been afforded protection between sand dunes. *Callitris preissii* is a long-lived species and can be indicative of fire history of an area. Keighery *et al.* (1997) states that *Callitris preissi* can reproduce readily from seed both with and without fire, and that the species has historically expanded in unburnt areas of Garden Island, Trigg and Woodman Point. Winn (2007) states

that the species reaches maturity about 10 years after germination, but that fires in the intervening period can interrupt the seeding cycle.

McArthur (1990) noted that *Callitris preissii* and *Melaleuca lanceolata* trees can live for more than 100 years and both species are killed by fire. McCaw (2007) noted there was little seedling regeneration of *Callitris preissii* four years after fire. Nine years post-fire, regeneration of the taxon was found to be more substantial and seedlings were producing cones. *Melaleuca lanceolata* is fire-sensitive but regenerates readily from seed after fire (McArthur 1990). These two species reproduce only by seed, and fire response needs to be taken into account when determining an appropriate inter-fire period. *Banksia sessilis* and *Templetonia retusa* are other serotinous taxa that occur in the community and are killed by fire and reproduce only from seed. Based on current data, an appropriate inter-fire interval for this community may be as long as 30-50 years, with this community often being dominated by very fire sensitive species.

Drying climate also needs to be considered when designing appropriate fire regimes. It is likely that reduced rainfall will cause diminishing growth rates, and plant maturation times will also therefore increase. Longer inter-fire intervals will therefore be desirable.

The remnants of the *Callitris preissii* (or *Melaleuca lanceolata*) forests and woodlands that are in best condition occur in Garden Island, probably due to a combination of factors. These include fire-suppression resulting in areas of long-unburnt vegetation, high level control of arum lily and other weeds, and a low level of disturbance impacts from relatively small numbers of recreational users.

Weed invasion

Disturbances such as fires and grazing can predispose areas to weed invasion if weed propagules are present. All of the occurrences of this community are close to weed sources such as urban or residential areas and would be vulnerable to weed invasion following any disturbance. However, even small remnants often exhibit surprising resistance to weed invasion particularly if left undisturbed (Keighery 1996). Survey data indicate that this community is highly susceptible to weed invasion following disturbance, and this may relate to its naturally low species diversity in the understorey.

There are tracks through most occurrences and weeds have invaded to varying extents along these tracks. Such areas should be considered a priority 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 current condition of occurrences of the community in the long term. Brown and Brooks (2002) state that the generic 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 generic weed control program would involve the following steps (adapted from Brown and Brooks 2002):

1. Identifying weeds present at the site and classifying them according to the threat they pose.
2. Accurately mapping the boundaries of weed populations, especially those of higher threat status.
3. Selecting an appropriate herbicide or other method of weed control for weed species that are present.
4. Controlling weeds that pose the greatest threat to the community and which are in the early stages of invasion.
5. Implementing a strategic control program for established weed populations, with highest priority to those posing the greatest threat to the community.
6. Rehabilitation through reintroduction of local native species where areas are no longer capable of regenerating following weed control.

Woodman Point and Peppermint Grove occurrences in particular, have high levels of weed invasion.

The most significant weeds in the community include arum lily, ink weed and thistle on Garden Island and grassy weeds, bridal creeper, dune onion weed, *Chamelaucium* (Geraldton wax) and Japanese pepper in other locations.

Hydrological changes

The Quindalup dunes on which most occurrences occur, comprise of sands made from shell fragments (calcium carbonate) that make the sands alkaline. These shell fragments dissolve and move down the profile and are deposited as lime. The Quindalup dunes hold very little water and are only wet at the surface in heavy rain. The dunes are also extremely infertile and when cleared of native vegetation, are very easily eroded by winds.

The *Callitris* forests and woodlands are most likely to be at least partially, a groundwater dependent ecosystem (GDE) that relies on groundwater for survival. If extraction of groundwater or developments that may otherwise impact groundwater quality or levels are planned in areas near the community, the following issues should be considered:

- natural patterns of recharge should be maintained,
- minimise disruption to groundwater levels,
- seek to maintain groundwater quality.

There are only three bores listed in Department of Water's Groundwater Information System for which groundwater data applicable to this community were available, and it is likely that the location data are not very accurate. The data indicate that where bores are located close to or within occurrences of the community, that groundwater was generally within 0.1m to 30m of the natural ground surface when bores were drilled. This was based on three bores drilled on Garden Island and that are probably not useful in determining water levels for the whole community. Further field analysis of bores within this community and groundwater information is required to determine water levels and quality in this community.

Developments with potential to alter water quality or levels in the habitat of this community have potential to impact on the community. The marina development at Mangles Bay will result in encroachment of the coastal saline wedge near this community (EPA 2013). Monitoring of the salinity and vegetation response in this community may provide opportunities for determining threshold levels of tolerance of the community to groundwater salinity.

Salinity levels of around 500 -1000 milligrams per litre total dissolved salts (mg/L TDS) have been recorded for the superficial aquifers where the community mostly occurs (Davidson 1995). Levels between 1000 - 1500 mg/L TDS were recorded for occurrence 2 (Peppermint Grove) adjacent to the Swan River. Values of TDS less than 1500 mg/L are considered fresh water.

Grazing

Grazing of plant communities causes alterations to species composition by the selective removal of edible species and the introduction and encouragement of weeds by the addition of dung, and through trampling and general disturbance. Keighery *et al.* (1997) note that grazing by tammars on Garden Island, by quokkas on Rottnest and by exotic herbivores can significantly impact regeneration of *Callitris preissii*. They also note that grazing and clearing account for loss of extensive stands of *Callitris preissii* but that there is no evidence of these forests extending beyond the Coogee-Cottesloe area and Garden Island.

Shedley (2007) notes that regeneration of *Callitris preissii* and *Melaleuca lanceolata* on Rottnest Island was largely prevented by overgrazing by quokkas during the 1930s to 1950s. Exclosure experiments have shown few seedlings of *Melaleuca* or *Callitris* can survive large populations of native grazers such as quokkas, and that grazing by native animals such as tammars or quokkas after fire may have greater impact on vegetation than fire.

Rottnest Island was historically covered with dense woodland and forests of *Callitris preissii*, *Melaleuca lanceolata* and *Pittosporum ligustrifolium*, with little understorey. A series of alternative states related to fire and grazing history were identified on Rottnest Island by Winn (2007). These are:

- *Callitris preissii – Melaleuca lanceolata* woodland dominates when hot fires occur with an inter-fire interval of at least 10 years, and the level of post-fire grazing by quokkas is limited
- *Acacia rostellifera* closed scrub occurs with a minimum eight year inter-fire interval, and limited post-fire quokka grazing.
- *Acanthocarpus preissii/ Austrostipa flavescens* heath dominates under high level grazing by quokkas.

Attempts at restoration of the *Callitris preissii/Melaleuca lanceolata* woodlands on Rottnest Island were historically not very successful due to high fire frequency, with *Callitris preissii* being the most fire-sensitive of the tree species on the island. Winn (2007) notes that in addition to an appropriate inter-fire interval, that regeneration of the woodlands required at least eight years reduced grazing pressure through fencing from quokkas to ensure successful regeneration.

Disease and Parasites

The fungus *Armillaria luteobubalina* has been found associated with dead or dying *Callitris preissii* (McArthur 1990). The fungus can essentially occur anywhere hardwoods are found growing. *Armillaria* commonly infects stressed trees that have been weakened by insects, other pathogens and/or climate stresses.

The parasitic mistletoe *Amyema melaleucae* is known to parasitise *Melaleuca lanceolata* (McArthur 1990), but has not been found to adversely affect the host.

The fungal disease myrtle rust (*Puccinia psidii s.l. syn. Uredo rangelii*) has the potential to infect many members of the family Myrtaceae. It was first detected in 2010 in a commercial nursery in eastern Australia. Rust spores can be dispersed by wind, honey bees, contaminated clothing, infected plant material and insect movement and have the potential to spread into south Western Australia. *Melaleuca lanceolata* is one of the dominant trees in the community, and, along with a suite of other Myrtaceae species that occur in the community (see Appendix 3) are potentially vulnerable to the infection if it is introduced into this State.

1.5 Important occurrences

Occurrences that are in best condition, provide for representation of the community across its geographic range and that can be managed for conservation and/or with conservation included in their purpose are considered critical to the survival of this community. Garden Island occurrences (3-41) are considered the most important occurrences as they are in best condition, cover relatively large areas and are subject to the lowest level of recreational impacts, fires and weed invasion (see Keighery *et al*. 1997). Other important occurrences include mainland coastal areas as follows: Woodman Point (occurrences 1, 42, 43, 45), Campbell Barracks (Occurrences 49, 50), Trigg Bushland (occurrence 48) as they are the largest remaining areas in best condition in coastal sites.

1.6 Affected interests

Occurrences of the community are located on land managed by Parks and Wildlife, other government agencies (Main Roads WA, Department of Defence, Department of Transport, Department of Sport and

Recreation, Department of Regional Development and Lands, Fremantle Port Authority, Swan River Trust and Rottnest Island Authority), local government authorities (Shire of Peppermint Grove, Town of Claremont, Town of Swanbourne, City of Stirling, City of Cockburn) and private land holders may be affected by actions in this plan, in particular where land is not managed by the Department of Parks and Wildlife.

1.7 Indigenous interests

The South West Aboriginal Land and Sea Council (SWALSC), an umbrella group, covers the areas considered in this plan. Appendix 2 identifies areas of the ecological community that contain sites that are known to have particular aboriginal significance. Action 2 identifies the intention to continue liaison with relevant groups, including indigenous groups.

1.8 Social and economic impacts and benefits

Pedestrian access by means of formal walk trails has potential to allow the aesthetic values of the community to be appreciated without degrading the community, and this provides a social benefit. Where specific active recreational pursuits such as four wheel driving and motorbike riding are prevented through access control, this may be perceived as a social impact, however such access control also helps to prevent the continued degradation of the community and maintain other social benefits.

Occurrences may be threatened by proposals to clear for various developments or from hydrological change following clearing and development of adjacent land. Implementation of actions such as seeking to protect the hydrological processes in the adjacent community may be perceived to result in an impact on development.

1.9 Related biodiversity impacts and benefits

Recovery actions implemented to improve the quality or security of the community are likely to improve the status of any species within the community and other associated vegetation types within managed areas of remnant vegetation. Three other TECs occur close to remnant vegetation containing this community and two declared rare flora have been identified as occurring within or adjacent to this community, but are considered unlikely to occur in this habitat. The Tammar wallaby (*Macropus eugenii),* Quokka *(Setonix brachyurus)* and Carpet python *(Morelia spilota imbricata)* are specially protected fauna that occur within some occurrences of this community. Threatened and priority species and communities that occur with or near the *Callitris preissii* (or *Melaleuca lanceolata*) forests and woodlands are:

Coastal shrublands on shallow sands (community type 29a, priority 3)
Acacia shrublands on taller dunes (community type 29b, priority 3)
Stromatolite-like microbialite community on Lake Richmond (critically endangered)
Sedgelands on Holocene dune swales (community type 19, critically endangered)
Microbialites and microbial mats of coastal hypersaline lakes (Rottnest lakes, priority 1)
Caladenia harringtoniae (declared rare flora)
Caladenia dorrienii (declared rare flora)
Macropus eugenii (priority 5)
Setonix brachyurus (vulnerable)
Morelia spilota imbricata (other specially protected fauna)

1.10 Term of plan

The plan will operate from 2014 to 2019 but will remain in force until withdrawn or replaced. It is intended that, if the ecological community is still listed as threatened in Western Australia after five years, the need for further recovery actions and the need for an updated recovery plan will be evaluated by the recovery team.

1.11 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 ecological characteristics of the community to develop further understanding about the management actions required to maintain or improve its condition.

2.0 RECOVERY OBJECTIVE AND CRITERIA

2.1 Objective

To maintain or improve the overall condition of the community in the known locations and reduce the level of threat with the aim of ensuring it does not meet criteria for a higher threat rank.

2.2. Criteria for success

- An increase in the number of occurrences of this community managed for conservation and/or with conservation included in the purpose.
- Representative areas of the community across its geographical range with condition rank maintained, or with improved condition rank (Bush Forever 2000 scales).
- 90% or more of the aerial extent of occurrences maintained at the same condition rank, or improved (Bush Forever 2000 scales).

2.3 Criteria for failure

- Decline in condition rank of 10% or more of the area of the community.
- Failure to achieve an increase in the area managed for conservation.

3.0 RECOVERY ACTIONS

3.0 Completed Actions

The following actions have been completed for the community since it was listed as threatened:

- All of the occurrences of the community have been mapped by Parks and Wildlife, and data stored on the corporate TEC database
- An article about the importance of the community was published in Landscope magazine in 2007
- Areas of the community that were historically burnt in Trigg bushland in 1993, 1998, 2000 and 2001 have been mapped.
- Parks and Wildlife installed ten quadrats on Garden Island in 2006, and two in Campbell Barracks in 2007 to determine floristic differences between this community and similar vegetation that does not contain *Callitris preissii* or *Melaleuca lanceolata*.
- Condition mapping and accurate boundary mapping were completed for occurrences of this community at Woodman Point in 2006 by Parks and Wildlife.
- Extensive weed control for arum lily (*Zantedeschia aethiopica*) was implemented in 2006 for occurrences 3-41 (Garden Island) by the Australian Government Department of Defence
- Australian Government Department of Defence undertook weed control by spraying and manually removal of *Zantedeschia aethiopica*, ink weed (*Phytolacca octandra*) and thistle (*Carduus* spp.) between the northern tip of Garden Island south to Gilbert Point road in 2011/2012.
- Condition assessment was completed by Parks and Wildlife for most occurrences in 2006 and in February 2012.
- Management plans have been developed for areas containing the TEC, as follows:
    - Department of Environment and Conservation (2010) is a management plan for an area that includes the Woodman Point occurrences
    - Rottnest Island Authority (2009) is a management plan that covers the two occurrences on the island
    - McArthur (1990) and Department of Defence (1980) outline management requirements for flora and fauna on Garden Island. McArthur (1990) outlines weed, grazing, fire, dune and rehabilitation requirements for vegetation management on the island.
    - The City of Stirling (2002) has adopted a Greenplan that is a general strategy for conservation of bushlands that include Trigg Bushland.
    - The Shire of Peppermint Grove adopted a riverside management strategy (Shire of Peppermint Grove 2006) to guide management of natural bushland including removal of exotic plantings, and plantings of native flora.

3.1 Recommended Recovery Actions

1. Coordinate Recovery Actions

The Swan Region Threatened Flora and Communities Recovery Team considers all threatened ecological communities and threatened flora in the Swan Region. This team will continue to assist Parks and Wildlife in

coordinating recovery actions for the community and other threatened flora and TECs in their region. They will include information on progress in annual reports to the department's Corporate Executive and funding bodies.

Responsibility: DPaW (Swan Region) with assistance from recovery team
Cost: $2,000 per year
Completion date: Ongoing

2. Continue liaison with land owners, land managers and other interested groups to implement recommendations

Most of the occurrences of the community are managed by authorities other than Parks and Wildlife, or are privately owned. The involvement of the following relevant land managers, local community groups, and industry in the recovery of the community is therefore essential to the recovery process:

- Department of Defence
- Town of Claremont, Shire of Peppermint Grove, City of Stirling, City of Nedlands, City of Cockburn, City of Rockingham
- Swan River Trust
- Department of Regional Development and Lands
- Department of Transport
- Fremantle Port Authority
- Department of Sport and Recreation
- Rottnest Island Authority

Indigenous groups will also be consulted about relevant on-ground actions in this plan.

To prevent accidental destruction of the community, and gain public support for its conservation, information about the community will continue to be provided by local Parks and Wildlife staff to all stakeholders including landholders, and managers of land containing the community. This would include information from the TEC database, maps indicating the location of the community, and this recovery plan.

Parks and Wildlife staff will ensure regular liaison with landowners and managers of land that contains the community to ensure TEC information is up to date.

Responsibility: DPAW (Swan Coastal District; Species and Communities Branch (SCB))
Cost: $4,000 pa for all liaison
Completion date: Ongoing

3. Continue to monitor the extent and boundaries of occurrences

To date many of the occurrences have been manually mapped or mapped using aerial photographs. Extent and boundary information will continue to be updated on the threatened ecological communities database.

Responsibility: DPAW (Swan Coastal District and SCB)
Cost: $2,000 every third year
Completion date: Ongoing

4. Encompass monitoring in an adaptive management framework

It is likely that the most important factors that will influence the future health and persistence of remnants of the *Callitris preissii* (or *Melaleuca lanceolata*) forests and woodlands will be inter-fire intervals, post-fire

grazing levels, and weed competition. Monitoring that is linked to the vegetation's responses to these pressures will therefore be most useful in guiding future management.
General monitoring established in the community includes success of weed control in the Garden Island occurrences, and monitoring programs established as part of the Management Plan for Woodman Point (Department of Environment and Conservation 2010). A consultant has been commissioned by the Department of Defence to assess populations of arum lily and major weed species on Garden Island. The survey has been undertaken by sampling grid-points throughout the entire island as part of the ongoing weed monitoring. This type of detailed monitoring is required to quantify the effects of on-ground management and to plan future management strategies.

Monitoring protocols will be based on those developed through the Resource Condition Monitoring project (eg Clarke 2009, and Brown and Clarke 2009). The monitoring will be linked to areas where active management or impacts are anticipated, so analysis of results can be incorporated to improve management of fire, hydrology, grazing by native or feral animals, weed invasion and other factors, as is recommended for an adaptive management framework.

A relatively small proportion of occurrences contain permanent quadrats (Gibson *et al.* 1994; DEP 1996; Parks and Wildlife unpublished data), with Occurrence 1 (MYWOODPT01), 42 to 47 (WOODP01, MYWOODPT03, PTPERON01, 02, MYWOODPT04 and ROTTNEST01, 02) and most locations with prefix 'MYGI' on Garden Island generally requiring quadrats. Where vegetation is in suitable condition, permanent quadrats should be established in these additional areas, utilising methods as described in Gibson *et al*. (1994). Data collected will include weed levels, plant species diversity and flora species composition. All native and weed species were recorded in quadrats that were previously established, but quantitative data that would provide information about density or cover for each species were not included in standard quadrat monitoring. Occurrences will be monitored every five years to provide information on composition, and condition. This information will be added to the TEC database.

Remote sensing data such as 'Vegetation Trend' from Landsat TM provides a coarse measure of change in vegetation cover. The interpretation of these data requires ground truthing as factors such as recovery from fire may not otherwise be evident. This remote sensing method may be suitable for some aspects of monitoring in future.

Responsibility: DPaW (Swan Coastal District, SCB)
Cost: $5000 every fifth year
Completion date: Ongoing

5. 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. In particular this will include determining the area required to maintain hydrological processes in the community. If any additional occurrences are located, then this habitat will also be determined and mapped for these locations.

Responsibility: DPaW (SCB, Swan Coastal District)
Cost: $5,000 in year 3
Completion date: Year 3

6. Develop and implement fire management strategy

Extensive analysis of historical loss, and success of regeneration programs for the *Callitris preissii* (or *Melaleuca lanceolata*) forests and woodlands on Rottnest Island by Winn (2007) indicate that inter-fire

intervals and grazing levels have historically had a very significant influence on persistence of natural areas of these woodlands, and on success of regeneration programs.

Burrows (2008) recommended fire regimes should be determined based on vital attributes, a diversity of frequency, season and intensity, and provide for habitat diversity and a fine-grain mosaic of habitats. Both *Callitris preissii* and *Melaleuca lanceolata* have a juvenile period of at least 10 years, and regenerate following fire. The juvenile periods are, however, likely to vary according to habitat and climate. Based on a ten year juvenile period for *Callitris preissii* and *Melaleuca lanceolata* it is recommended that a minimum inter-fire interval of 20 years (ie twice the juvenile period of the slowest maturing species) should be implemented in the community, and this should be applied in a variety of seasons, and intensities. The outcomes of implementation of a particular regime on the composition and structure of the community should be quantitatively monitored and results and data analysis incorporated into an adaptive management framework. Fire history maps also need to be developed for occurrences of the community, and updated annually.

An example of an appropriate fire regime would be to burn 60-80% of an occurrence in a low intensity spring burn, about 20 years following previous fire. This should be interspersed with much longer inter-fire intervals such as 3-4 times the juvenile period of the slowest maturing species, which is 30-40 years in the case of *Callitris preissii* and *Melaleuca lanceolata*.

Occurrences 3-41 (Garden Island) are currently managed in a no burn regime that has not seen fire since 1956 and the TEC maintains good condition under that regime. Although positive results from reasonably long-term fire exclusion are indicated in the Garden Island occurrences, it is unlikely that fire could successfully be excluded for such lengthy periods in mainland occurrences due to the frequency of bushfires in bushland with easy access close to human population centres.

Maintenance of existing firebreaks is appropriate where firebreaks are already constructed, unless maintenance is likely to cause spread or intensification of disease or otherwise degrade the community. Careful use of herbicides is the preferred method of maintenance of firebreaks to minimise soil movement and risk of disease spread or intensification in the community. No new firebreaks should be constructed in intact vegetation in occurrences. Local Parks and Wildlife staff will be involved in planning fire break construction and maintenance for the community.

Fire management or response plans have been developed for some occurrences (Occurrences 3-41 Garden Island). Fire fighting authorities need to recognise the importance of not constructing new tracks during their operations, including during bushfires. The use of heavy machinery to create new fire breaks within the community should be avoided to avoid further degrading the community, and chemicals that may be toxic to the community should not be used.

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

Responsibility: DPaW (Swan Coastal District), in liaison with surrounding landholders
Cost: $7,000 pa
Completion date: Ongoing

7. Implement weed control, and replant where necessary

Weed control plans will be developed for all areas of bushland that contain the community and will be based on information from weed mapping. Plans will identify the highest priority weeds that pose the greatest threat to the community in the early stages of invasion where possible (see Appendix 2).

Appropriate methods of weed control are found in Brown and Brooks (2002) and may include hand weeding or localised application of herbicide. The herb layer is an integral part of this plant community and care will need to be taken to minimise disturbance of native herbs in any weed control program.

Rehabilitation through reintroduction of local native species may be necessary if areas are no longer capable of regenerating following weed control. Piles of weed-contaminated soil in any occurrences should be removed and the areas replanted. Tracks excess to requirements should be left to revegetate naturally. Seed from the same occurrence should ideally be used for rehabilitation but this may not be practical where species richness of sites is depleted.

Highest priorities include maintenance of control of arum lily, ink weed and thistle on Garden Island and monitoring and control of these weeds and of other major weeds including bridal creeper, dune onion weed and grassy weeds that have potential for significant impacts in other locations as they are highly invasive.

Responsibility: DPaW (Swan Coastal District) in consultation with landholders, land managers.
Cost: $5,000 pa for weed control in all occurrences; rehabilitation requirements of other occurrences need to be determined
Completion date: Ongoing

8. Determine the 'normal range' of groundwater levels and quality, and evaluate significant changes in relation to flora composition

Historical and current data from bores within the community will be examined to determine trends in groundwater levels and quality for suitable bores in occurrences likely to be remote from most human induced changes, and in some in which hydrological change is suspected. This will provide a description of the normal range and fluctuation in water levels and quality, in the community's habitat. Data will be more indicative of tolerance levels if linked with future monitoring of the composition of the community.

Responsibility: DPaW (Species and Communities Branch, Swan Coastal District) in consultation with landholders, land managers
Cost: $3,000 pa in years 2, 3 to investigate available data
Completion date: Year 3

9. Seek to influence land management practices to minimise direct clearing and hydrological change

Some occurrences of the community may be at risk from hydrological impact from adjacent developments, for example occurrence 44.

Parks and Wildlife will seek to influence the management of bushland that contains occurrences and adjacent lands that are likely to occur in areas that influence the hydrology such that groundwater and surface water processes are maintained within likely limits of tolerance. The limits of tolerance to change in groundwater levels and quality are not known and will only be determined through the application of an adaptive management framework that links monitoring of changes to water levels and quality to vegetation change.

Hydrology will be managed within an adaptive management framework, with detailed quantitative monitoring of floristic composition and structure linked to areas where there is likely to be significant hydrological change in terms of groundwater or surface water levels or quality.

Parks and Wildlife will continue to negotiate to seek minimal future clearing of the community.

Responsibility: DPaW (Swan Coastal District, SCB); in liaison with Department of Water
Cost: $1,000 pa
Completion date: Ongoing

10. Fence remnants that contain the community, where necessary

Fencing may be necessary to prevent degradation where occurrences are in high usage areas. Occurrences 1, 42, 43 and 45 (Woodman's Point) occur near beach, camping and recreational areas which are currently impacted by crushing and trampling. Occurrences 46 and 47 (Rottnest Island) are impacted by visitors walking through the occurrences. Tracks used by four wheel motorbikes surround Occurrence 50 (Swan02, Swan02b). The requirement for, and feasibility of, fencing these areas needs to be assessed. Most occurrences are already fenced, and there is little evidence of broad-scale degradation of other occurrences as a result of uncontrolled vehicle access.

Responsibility: DPaW (Swan Coastal District), landowners and managers
Cost: To be determined
Completion date: Year 2

11. Clarify the identity of additional potential occurrences

The identity of the floristic community types of potential additional occurrences needs to be confirmed. Potential occurrences at Hillarys (Ern Halliday recreation camp) require further investigation as it is unclear whether *Callitris preissii* present has been planted. Statistical analyses of quadrat data for this particular site completed in 2013 indicate alignment with floristic community type 29a 'coastal shrublands on shallow sands', however, the *Callitris preissii* community links to the coastal shrublands type when it has suffered a level of degradation (G. Keighery personal communication).

Responsibility: DPaW (Swan Coastal and Albany Districts)
Cost: $5,000 in year 4
Completion date: Year 4

12. Develop management guidelines

Up to date management guidelines are required for each major bushland area that contains the community. The management guidelines will include a weed map, weed control strategy, and a detailed fire management strategy, as described in other actions.

Parks and Wildlife will seek involvement in the cooperative preparation of guidelines for occurrences that include management considerations as listed in this plan if site-based management guidelines for areas that contain the *Callitris* community are not already being prepared or implemented.

Currently, there is no detailed management plan in place for the Swanbourne (Campbell Barracks) occurrences (occurrence 49 and 50).

Responsibility: DPaW (Swan Coastal District), and land managers
Cost: $10,000 in year 3
Completion date: Year 2, 3

13. Seek long term protection of areas of the community

If suitable areas that contain the community become available, Parks and Wildlife will negotiate to have the remnants that contain the community, and adequate buffer areas where required, protected through

perpetual protection agreements or reserved as conservation reserves vested with the Conservation Commission of WA.

This recommendation refers to Occurrence 43 and 45 at Woodman Point (MYWOODPT03, MYWOODPT04). In addition, if the Department of Defence discontinues their requirements for portions of Garden Island and/or Campbell Barracks then Parks and Wildlife will seek the transfer of the land for conservation purposes.

Responsibility: DPaW (Land Unit; Swan Coastal District; SCB)
Cost: Costs of liaison included as part of action 2
Completion date: To be determined - when land, and resources available

14. Report on success of management strategies

Reporting will be part of annual reports prepared by the Recovery Team for the Department of Parks and Wildlife Corporate Executive, and will include results of analysis of monitoring within an adaptive management framework. A final report will be presented as part of the next review and update of the recovery plan, if deemed necessary.

Responsibility: DPaW (Swan Coastal District; SCB)
Cost: $3,000 pa
Completion date: Year 5

Table 3: Summary of costs for each recovery action

Recovery Action	Year 1	Year 2	Year 3	Year 4	Year 5
Coordinate recovery actions	2,000	2,000	2,000	2,000	2,000
Continue liaison to implement recommendations	4,000	4,000	4,000	4,000	4,000
Continue to monitor extent and boundaries	2,000			2,000	
Encompass monitoring in adaptive management framework	5,000				
Map habitat critical to survival			5,000		
Develop and implement fire management strategy	7,000	7,000	7,000	7,000	7,000
Implement weed control	5,000	5,000	5,000	5,000	5,000
Determine 'normal range' of groundwater levels, quality		3,000	3,000		
Seek to influence land management practices to manage hydrology	1,000	1,000	1,000	1,000	1,000
Fence remnants that contain the community	TBD	TBD	TBD	TBD	TBD
Clarify the identity of additional potential occurrences				5,000	
Develop management guidelines			10,000		
Seek long term protection of areas of the community	TBD	TBD	TBD	TBD	TBD
Report on success of management strategies	3,000	3,000	3,000	3,000	3,000
Total	**29,000**	**25,000**	**40,000**	**29,000**	**22,000**

TBD: to be determined

Total of all costs over five years: **$ 145,000** (not including uncosted actions)

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Extent, location and management of occurrences (as listed in TEC database; see also Figure 1)

Occ. Number	Location	Land Owner/ Manager	Management comments	Estmtd area (ha)	Comments
Occurrence 1 (MYWOODPT01)	Lot 58 on Plan 14758	Department of Regional Development and Lands		5.56	Bush Forever Site; Woodman Point, Coogee/Munster Woodman Point Regional Park
	Lot 58 on Plan 14758	Department of Regional Development and Lands			
	Crown Reserve 49218	WA Department of Transport	Recreation		
	Lot 51 on Plan 14756	Department of Regional Development and Lands			
	Lot 52 on Plan 14756	Department of Regional Development and Lands			
	Lot 50 on Plan 147579	Department of Regional Development and Lands			
	Crown Reserve 41158	Fremantle Port Authority	Navigation Aid		
	Lot 55 on Plan 14756	Department of Regional Development and Lands	Marina		
	Crown Reserve 49220	Department of Regional Development and Lands			
	Lot 500 on Plan 56133	Department of Parks and Wildlife (DPAW), Conservation Commission of WA (CCWA)	Conservation, Park		
	Lot 52 on Plan 14756	Department of Regional Development and Lands			
	Crown Reserve 49220	DPAW, CCWA	Conservation, Park		
Occurrence 2 (PEPGR01, 02)	Crown Reserve 25423	Town of Claremont	Recreation	3.15	Bush Forever Site; Peppermint Grove Foreshore
	Crown Reserve 48325	Swan River Trust	Landscape Protection		
	Road Reserve				
	Crown Reserve 17113	Management Order Shire of Peppermint Grove	Recreation		
	Crown Reserve 17113	Management Order Shire of Peppermint Grove	Recreation		
Occurrence 3 (MYGI01)	Lot 9 on Plan 226190	Australian Government Department of Defence	Naval Base	0.85	Bush Forever Site; Garden Island
Occurrence 4 (MYGI02)	Cocloc9	Australian Government Department of Defence	Naval Base	1.26	Bush Forever Site; Garden Island
Occurrence 5 (MYGI03)	Lot 9 on Plan 226190	Australian Government Department of Defence	Naval Base	16.19	Bush Forever Site; Garden Island
	Cocloc9	Australian Government Department of Defence	Naval Base		

Occurrence 6 (MYGI04)	Lot 9 on Plan 226190	Australian Government Department of Defence	Naval Base	2.47	
Occurrence 7 (MYGI05)	*Lot 9 on Plan 226190*	*Australian Government Department of Defence*	*Naval Base*	*N/B*	*Cleared*
Occurrence 8 (MYGI06)	*Cocloc9*	*Australian Government Department of Defence*	*Naval Base*	*N/B*	*Cleared*
Occurrence 9 (MYGI07)	*Lot 9 on Plan 226190*	*Australian Government Department of Defence*	*Naval Base*	*N/B*	*Cleared*
Occurrence 10 (MYGI08)	*Lot 9 on Plan 226190*	*Australian Government Department of Defence*	*Naval Base*	*N/B*	*Cleared*
Occurrence 11 (MYGI09)	Lot 9 on Plan 226190	Australian Government Department of Defence	Naval Base	0.95	Bush Forever Site; Garden Island
Occurrence 12 (MYGI10)	Lot 9 on Plan 226190	Australian Government Department of Defence	Naval Base	16.68	Bush Forever Site; Garden Island
Occurrence 13 (MYGI11)	Lot 9 on Plan 226190	Australian Government Department of Defence	Naval Base	N/B	Bush Forever Site; Garden Island, Cleared
Occurrence 14 (MYGI12)	Lot 9 on Plan 226190	Australian Government Department of Defence	Naval Base	1.71	Bush Forever Site; Garden Island
Occurrence 15 (MYGI13)	Lot 9 on Plan 226190	Australian Government Department of Defence	Naval Base	0.78	Bush Forever Site; Garden Island
Occurrence 16 (MYGI14)	Lot 9 on Plan 226190	Australian Government Department of Defence	Naval Base	1.8	Bush Forever Site; Garden Island
Occurrence 17 (MYGI15)	Lot 9 on Plan 226190	Australian Government Department of Defence	Naval Base	7.99	Bush Forever Site; Garden Island
Occurrence 18 (MYGI16)	Lot 9 on Plan 226190	Australian Government Department of Defence	Naval Base	4.29	Bush Forever Site; Garden Island
Occurrence 19 (MYGI17, 19, 49)	Lot 9 on Plan 226190	Australian Government Department of Defence	Naval Base	9.51	Bush Forever Site; Garden Island
Occurrence 20 (MYGI18)	Lot 9 on Plan 226190	Australian Government Department of Defence	Naval Base	7.52	Bush Forever Site; Garden Island
Occurrence 21 (MYGI20)	Lot 9 on Plan 226190	Australian Government Department of Defence	Naval Base	5.51	Bush Forever Site; Garden Island
Occurrence 22 (MYGI21)	Lot 9 on Plan 226190	Australian Government Department of Defence	Naval Base	17.29	Bush Forever Site; Garden Island
Occurrence 23 (MYGI22)	Lot 9 on Plan 226190	Australian Government Department of Defence	Naval Base	5.41	Bush Forever Site; Garden Island
Occurrence 24 (MYGI23)	Lot 9 on Plan 226190	Australian Government Department of Defence	Naval Base	1.08	Bush Forever Site; Garden Island
Occurrence 25 (MYGI24)	Lot 9 on Plan 226190	Australian Government Department of Defence	Naval Base	8.03	Bush Forever Site; Garden Island
Occurrence 26 (MYGI25)	Lot 9 on Plan 226190	Australian Government Department of Defence	Naval Base	0.57	Bush Forever Site; Garden Island
Occurrence 27 (GARD04)	Lot 9 on Plan 226190	Australian Government Department of Defence	Naval Base	3.5	Bush Forever Site; Garden Island
Occurrence 28 (GARD09,	Lot 9 on Plan 226190	Australian Government Department of Defence	Naval Base	35.38	Bush Forever Site; Garden

MYG27, 32, 36)					Island
	Cocloc9	Australian Government Department of Defence	Naval Base		
Occurrence 29 (GARD06, 07, MYG28, 29, 30, 31, 33, 34, 35)	Lot 9 on Plan 226190	Australian Government Department of Defence	Naval Base	79.57	Bush Forever Site; Garden Island
Occurrence 30 (GARD01, 03, GI-01 PLOT)	Lot 9 on Plan 226190	Australian Government Department of Defence	Naval Base	196.38	Bush Forever Site; Garden Island
Occurrence 31 (MYGI38)	Lot 9 on Plan 226190	Australian Government Department of Defence	Naval Base	4.97	Bush Forever Site; Garden Island
Occurrence 32 (MYGI39)	Lot 9 on Plan 226190	Australian Government Department of Defence	Naval Base	5.34	Bush Forever Site; Garden Island
Occurrence 33 (MYGI40)	Lot 9 on Plan 226190	Australian Government Department of Defence	Naval Base	2.21	Bush Forever Site; Garden Island
Occurrence 34 (MYGI41)	Lot 9 on Plan 226190	Australian Government Department of Defence	Naval Base	5.31	Bush Forever Site; Garden Island
Occurrence 35 (MYGI42)	Lot 9 on Plan 226190	Australian Government Department of Defence	Naval Base	1.72	Bush Forever Site; Garden Island
Occurrence 36 (MYGI43)	Lot 9 on Plan 226190	Australian Government Department of Defence	Naval Base	0.97	Bush Forever Site; Garden Island
Occurrence 37 (MYGI44)	Lot 9 on Plan 226190	Australian Government Department of Defence	Naval Base	1.51	Bush Forever Site; Garden Island
Occurrence 38 (MYGI45)	Lot 9 on Plan 226190	Australian Government Department of Defence	Naval Base	6.18	Bush Forever Site; Garden Island
Occurrence 39 (MYGI46)	Lot 9 on Plan 226190	Australian Government Department of Defence	Naval Base	0.82	Bush Forever Site; Garden Island
Occurrence 40 (MYGI47)	Lot 9 on Plan 226190	Australian Government Department of Defence	Naval Base	0.74	Bush Forever Site; Garden Island
Occurrence 41 (MYGI48)	Lot 9 on Plan 226190	Australian Government Department of Defence	Naval Base	1.94	Bush Forever Site; Garden Island
	Cocloc9	Australian Government Department of Defence	Naval Base		
Occurrence 42 (MYWOODPT02, WOODP01)	Lot 58 on Plan 14758	Department of Regional Development and Lands		103.37	Bush Forever Site; Woodman Point, Coogee/Munster Woodman Point Regional Park
	Lot 50 on Plan 14757	Department of Regional Development and Lands			
	Lot 56 on Plan 14758	Department of Regional Development and Lands			
	Lot 61 on Diagram 67078	Department of Regional Development and Lands			
	Crown Reserve 24306	City of Cockburn	Recreation; Amenities; Reserve		
	Crown Reserve 42469	DPaW, Executive Director of the Department of Parks and Wildlife	Conservation; Fauna; Protection of Flora; Marina		

	Crown Reserve 42469	DPaW, Executive Director DPaW	Conservation; Fauna; Protection of flora; Reserve		
	Lot 52 on Plan 14756	Department of Regional Development and Lands			
	Road Reserve				
	Crown Reserve 42469	DPaW, Executive Director DPaW	Conservation; Fauna; Protection of flora		
	Lot 53 on Plan 14756	Department of Regional Development and Lands			
	Lot 52 on Plan 14756	Department of Regional Development and Lands			
	Lot 58 on Plan 14758	Department of Regional Development and Lands			
	Crown Reserve 29678	City of Cockburn	Caravan Park;		
	Railway Reserve				
	Crown Reserve 42469	DPaW, Executive Director DPaW	Conservation; Fauna; Protection of flora		
	LOT 55 on Plan 14756	Department of Regional Development and Lands	Marina		
	LOT 50 on Plan 14757	Department of Regional Development and Lands	Conservation; Park		
	LOT 57 on Plan 14758	Department of Regional Development and Lands			
	LOT 52 on Plan 14756	Department of Regional Development and Lands			
	CROWN RESERVE 49220	DPaW, CCWA	Conservation; Park		
	LOT 58 on Plan 14758	Department of Regional Development and Lands			
	LOT 52 on Plan 14756	Department of Regional Development and Lands			
	Crown Reserve 42469	DPaW, Executive Director DPAW	Conservation; Fauna; Protection of flora		
	Lot 54 on Plan 14756	Department of Regional Development and Lands			
	Lot 52 on Plan 14756	Department of Regional Development and Lands			
	Lot 300 on Plan 50276	WA Department of Sport and Recreation	Recreation; Jetty; Quarters		
Occurrence 43 (MYWOODPT03)	Crown Reserve 40184	WA Department of Sport and Recreation	Recreation; Jetty; Quarters	1.57	Bush Forever Site; Woodman Point, Coogee/Munster Woodman Point Regional Park

Occurrence 44 (PtPeron01, 02)	Crown Reserve 48968	DPaW	Rockingham Lakes Regional Park Recreation	3.611	Bush Forever Site; Point Peron and Adjacent Bushland, Peron/Shoalwater Bay
	Road Reserve				
Occurrence 45 (MYWOODP04)	Crown Reserve 49218	WA Department of Transport	Recreation; Shipyard	10.51	Bush Forever Site; Woodman Point, Coogee/Munster Woodman Point Regional Park
	Crown Reserve 49218	Department of Transport	Recreation		
	Lot 61 on Diagram 67078	Department of Regional Development and Lands			
	Lot 52 on Plan 14756	Department of Regional Development and Lands			
	Road Reserve				
Occurrence 46 (Rottnest01)	Crown Reserve 16713	Rottnest Island Authority, City of Cockburn	Government Requirements	7.85	
Occurrence 47 (Rottnest02)	Crown Reserve 16713	Rottnest Island Authority, City of Cockburn	Government Requirements	19.66	
Occurrence 48 (TRIGG02)	Road Reserve			16.41	Bush Forever Site; Trigg Bushland and Adjacent Coastal Reserve, Trigg/Scarborough
	Lot 155 on Plan 10163				
	Crown Reserve 32559 (Trigg Town site Lot 1)	City of Stirling	Conservation; Dune Protection; Education Purposes; Recreation		
Occurrence 49 (SWAN01 PLOT)	Lot 0 on diagram 3255	Australian Government Department of Defence		0.17	Bush Forever Site; Swanbourne Bushland, Swanbourne/City Beach
Occurrence 50 (Swan02, Swan02b)	Lot 0 on Diagram 3255	Australian Government Department of Defence		0.34	Bush Forever Site; Swanbourne Bushland, Swanbourne/City Beach

APPENDIX 2

Environmental and cultural parameters

Occ. Number	Major Threats	Quadrat	Predominant Landform unit #	Depth to groundwater *	Last Known Fire	Aboriginal sites	Condition++
Occ. 1 (MYWO ODPT01)	Too frequent fire, weed Invasion	No	Quindalup Dunes	No borehole or well in close proximity	Area burnt 1949 Most Callitris forest burnt 1991	Mythological Sites nearby (within approx 250m)	Very good to good condn. Eastern side burnt on 8/04/2006.
Occ. 2 (PEPGR0 1, 02)	Too frequent fire, weed Invasion	Yes	Cottesloe Complex	38m (borehole or well 50m west of occurrences) on 21/04/1978		Within Ceremonial, Mythological Site	Majority good condn with parts excellent. Likely long unburnt.
Occ. 3-41 (MYGI01 - 48, GARD01, 03, 04, 06, 07, 09, GI-01 PLOT)	Too frequent fire (high levels of leaf litter), weed invasion , clearing (mining application); Defence Dept may require additional area for buildings etc. in future	No quadrats for any MYGI occurrences. All GARD and GI-01 have quadrats	Quindalup Dunes	MYGI03 - 3.66m (borehole or Well within occurrence) on 30/06/1973	1/01/1956 Severe Fire 1999 (MYGI38 only)	Within Mythological, Artefacts / Scatter, Midden / Scatter, Historical site	Majority of occurrences very good to excellent. Likely long unburnt.
				MYGI04 0.14m from top casing (borehole or well within Occurrence) on 28/05/2009			
				MYGI11 10m (borehole or well within occurrence) on 09/07/1990)			
				MYGI17 Not Specified (borehole or well within occurrence)			
				MYGI48 4.38m (borehole or well 72m southwest of boundary) on 28/05/2009			
Occ. 42 (MYWO ODPT02, WOODP 01)	Too frequent fire, weed invasion, grazing by rabbits	WOODP 01 = quadrat MYWOO DPT02 - no quadrat	Quindalup Dunes	11m (borehole or well 100m west) 04/09/1980	Area burnt 1949 (Powell and Emberson, 1981). Most Callitris burnt 1991 (Keighery, 1993) 2010 long unburnt near Jervois Bay	Mythological sites nearby (within approx 250m)	Excellent to very good condition. Small area burnt on the eastern side of occurrence on 1/1/1999

					Sailing Club		and 9/4/2011.
Occ. 43 (MYWO ODPT03)	Too frequent fire, weed invasion, grazing by rabbits	No	Quindalup Dunes	No borehole or well in close proximity	Area burnt 1949 (Powell and Emberson, 1981). Most Callitris forest burnt 1991 (Keighery, 1993)	Within Mythological Site	Good condition. Likely long unburnt.
Occ. 44 (PtPeron 01, 02)	Too frequent fire, weed invasion (Japanese pepper – *Schinus terebinthifolia*), clearing, salinisation	No	Quindalup Dunes	1.8m (borehole or well 170m south west) on 30/06/1964)	Most Callitris forest burnt 1991 (Keighery, 1993)	Mythological/ Ceremonial sites nearby (within approx 250m)	Very good condition. Northern tip burnt 2/1/2006, south east tip burnt 1/1/2006 and western half of occurrence burnt 3/2/2006.
Occ. 45 (MYWO ODP04)	Too frequent fire Weed Invasion - some grassy weeds around periphery, grazing by rabbits	No	Quindalup Dunes	No borehole or well in close proximity	Area burnt 1949 (Powell and Emberson, 1981). Most Callitris forest burnt 1991 (Keighery, 1993)	Mythological Sites nearby (within approx 250m)	Good condition. Western side burnt on 8/4/2006 and eastern side burnt 29/11/2004.
Occ. 46, 47 (Rottnes t01, 02)	Grazing by native or introduced species- quokka grazing heavy, recreational activities - visitors walking through occurrence	No	Quindalup Dunes	2.26m (unknown feature, 50m from Rottnest01) on 27/05/1980	Area burnt 1949 (Powell and Emberson, 1981). Most Callitris forest burnt 1991 (Keighery, 1993)	Within Mythological, Skeletal material /Burial, Man-Made Structure, Quarry, Artefacts/ Scatter, Midden / Scatter, Historical sites (Wadjemup)	Excellent condition. Likely long unburnt.
Occ. 48 (TRIGG0 2)	Fire - historical fire regime may have modified the community. Recreational activities- many dune tops bare, may be due to fire or walker impacts. Weed invasion- a few garden escapes around periphery and grassy weeds inside reserve	yes	Quindalup Dunes	Not specified (bore within occurrence)	Unknown fire history	No known sites in close proximity.	Very good condition. Likely long unburnt.

Occ. 49 (SWAN01 PLOT)	Recreational activities- users of rifle range walking in occurrences. Weed invasion- eg Chamelaucium and asparagus creeper	yes (yet to be analysed)	Quindalup Dunes	No borehole or well in close proximity	Area burnt around 1960s	Mythological, Historical Sites nearby (within approx 250m)	Very good to excellent condition. Likely long unburnt.
Occ. 50 (Swan02, Swan02b)	Recreational activities- four wheel motorbikes - tracks encircling occurrence. Weed invasion- grassy weeds and asparagus creeper	yes	Quindalup Dunes	No borehole or well in close proximity	Area burnt around 1960s	Mythological, Historical Sites nearby (within approx 250m)	Good. Likely long unburnt.

#(Churchward and McArthur 1980; Tille and Lantzke 1990a)

*Static level m below ground; from DoW Groundwater - Water Information System (WIN)

++Field survey data

APPENDIX 3

Ecological characteristics of native flora commonly recorded in occurrences

Floristic data from DEP (1996) has not been incorporated into this table. Information is based on quadrats in occurrences 2, 3, 4, 5, 6, 7 and 10 only. Occurrences 1, 8 and 9 were recorded in DEP (1996), with other floristic data from Gibson *et al*. (1994).

Taxon	**Fire response (Source-Naturemap)**	**Months to first flowering** (Source-Naturemap unless stated)	**Months to peak flowering** (Source-Naturemap)	**Months to flowering Decline** (Source-Naturemap)	**Longevity** (Source-Naturemap)
Acacia rostellifera	100% scorch kills, in soil seed storage	36			Perennial
Acacia xanthina	ND				
Acanthocarpus preissii	Survives 100% scorch, soil suckers	30			Perennial
Agrostis preissii	ND				
Alyxia buxifolia	ND				
Apium annuum	ND				
Austrostipa elegantissima	ND				
Austrostipa flavescens	ND				
Banksia sessilis	100% scorch kills, on plant seed storage	48			Perennial
Caladenia latifolia	Geophyte (Survives 100% scorch)	12			Perennial
Calandrinia calyptrata	100% scorch kills, in soil seed storage	6			Annual
Callitris preissii	100% scorch kills, in soil seed storage	9-10 years (McCaw 2007; Winn 2007)	?	?~100 years	Perennial
Catapodium rigida	ND				
Clematis linearifolia	ND				
Conostylis candicans	ND				
Crassula colorata	ND				
Dianella revoluta	Survives 100% scorch, soil suckers	36			Perennial
Diplolaena dampieri	ND				
Dodonaea hackettiana	ND				
Eremophila glabra		48			Perennial
Eucalyptus gomphocephala	Survives 100% scorch, epicormics	48			Perennial
Grevillea preissii	ND				
Hardenbergia comptoniana	Survives 100% scorch, basal sprouts	30			Perennial
Lepidium puberulum	ND				
Leucopogon australis	Survives 100% scorch, basal	16			Perennial

	sprouts				
Logania vaginalis	Survives 100% scorch (any of the following soil suckers, basal sprouts, epicormics, large apical bud, geophyte)	20			Perennial
Lomandra maritima	ND				
Melaleuca systena	Survives 100% scorch, basal sprouts	24			Perennial
Melaleuca huegelii	Survives 100% scorch, basal sprouts				Perennial
Melaleuca lanceolata		36			Perennial
Microlaena stipoides	Survives 100% scorch, soil suckers	12			Perennial
Myosotis australis	ND				
Oxalis perennans	ND				
Parietaria debilis	ND				
Phyllanthus calycinus	Survives 100% scorch, soil suckers	24			Perennial
Pittosporum ligustrifolium (previously *P. phillyreoides)*	Survives 100% scorch, basal sprouts	84			Perennial
Poranthera microphylla	100% scorch kills, in soil seed storage	12			Annual
Rhagodia baccata subsp. *baccata*	ND				
Santalum acuminatum	ND				
Scaevola crassifolia	100% scorch kills, in soil seed storage	30			Perennial
Schoenus grandiflorus	Survives 100% scorch, soil suckers	12			Perennial
Solanum symonii	RD				
Spyridium globulosum	100% scorch kills, in soil seed storage	6			Perennial
Templetonia retusa	100% scorch kills, in soil seed storage	48			Perennial
Thomasia cognata	ND				
Thysanotus arenarius	ND				
Thysanotus patersonii	Survives 100% scorch, soil suckers	22			Perennial
Trachymene coerulea	ND				
Trachymene pilosa	100% scorch kills, in soil seed storage	12			Annual
Tricoryne elatior	100% scorch kills, in soil seed storage	24			Perennial
Trymalium ledifolium	ND				

ND = no data available in Naturemap

APPENDIX 4

STATUS OF FLORA TAXA (From Smith 2010)

Threatened	'taxa which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection and have been gazetted as such.'
Priority 1	'taxa which are known from one or a few populations which are under threat.'
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.'
Priority 4	'taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable