

Mundijong Road Reserve and Duckpond Reserve

Management Plan



Photo: Greg Keighery

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Mundijong Road Reserve and Duckpond Reserve Management Plan

2004 – 2009

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Shire of Serpentine-
Jarrahdale
Soldiers Road, Mundijong,
WA

Serpentine-Jarrahdale Land
Conservation District Committee
Soldiers Road, Mundijong, WA

March 2004



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FOREWORD

The development of the Management Plan for Mundijong Road Reserve and Duckpond Reserve has occurred for two reasons:

- As a condition of the Shire of Serpentine-Jarrahdale “to ensure the reserve(s) are managed in partnership with the local authority” prior to transfer to the Conservation Commission of Western Australia whereupon they will be managed by the Department of Conservation and Land Management (hereafter referred to as CALM).
- Prior to gazettal under the *Conservation and Land Management Act 1984*.

The purpose of the plan is to provide guidance for the future management of Mundijong Road Reserve and Duckpond Reserve. It outlines the management actions that are required to urgently address principal threatening processes most affecting the continued existence of the vegetation on these reserves.

The management of the reserves will be co-ordinated under a Management Order by the Shire of Serpentine-Jarrahdale. Many of the management actions cited herein are already being progressed by community volunteers and/or officers of the Shire of Serpentine-Jarrahdale.

The reserve has extremely high conservation, scientific and educational values. Namely:

- Recognised as being one of the only two intact transects of native vegetation that span the various plant communities that run east-west across the Swan Coastal Plain (Gibson *et al.* 1994).
- Duckpond Reserve is the only ‘Boyanup’ soil type with remnant vegetation remaining on the Swan Coastal Plain.
- Contains four threatened ecological communities. Two of these are ranked as Endangered (Government of Western Australia 2000).*
- These community types and the generally intact condition of the vegetation afford the reserve regional significance and the reserves are a Bush Forever site (#360).
- The reserve together with Soldiers Road Flora Reserve form a corridor of bushland from Byford to Duckpond Road and also connect with Byford to Serpentine Rail/Road reserve (Bush Forever sites 350 and 365), increasing its significance as a conservation reserve.
- Contains ten species of threatened plant taxa, 74 taxa that are characteristic of the eastern side of the Swan Coastal Plain and at least 12 taxa that are endemic to the eastern portion of the plain (Keighery 1996). CALM is legally obliged to protect Declare Rare Flora.
- The reserve has recreation value for activities such as walking, bird watching and picnic site and is part of a Flora Road Circuit.

*[CALM is committed to ensuring that Critically Endangered ecological communities are conserved through the preparation and implementation of Recovery Plans (RPs) or Interim Recovery Plans (IRPs). IRPs 59 and 60 address the management of the communities found on Mundijong Road and Duckpond Reserve (English and Blyth 2000a, b).]

The Management Plan will operate from *March 2004* to *February 2009* but will remain in force until withdrawn or replaced.

The provision of funds identified in this plan is dependent on budgetary and other constraints affecting CALM, as well as the need to address other priorities.

Information in the Management Plan was accurate at March 2004.

SUMMARY

Name: Mundijong Road Reserve and Duckpond Reserve

Description: Mundijong Road Flora Reserve and Duckpond Reserve are two native vegetation remnants in Mundijong, Western Australia. Both reserves are included within Bush Forever Site 360. Mundijong Road Flora Reserve (No. 23793) is a 12 kilometre long linear corridor (36.1 hectares), that runs adjacent to and south of Mundijong Road from Paterson Road to the boundary of the City of Rockingham (Figure 1). The width of Mundijong Reserve varies from 25 to 45 metres. Land to the north of Mundijong Road is cleared private land. A drainage channel managed by the Water Corporation runs alongside a portion of the road.

Duckpond Reserve (Lot 101) is a small triangular-shaped remnant (2.9112 hectares) found at the western end of Mundijong Road Flora Reserve, on the northern side of Mundijong Road (Figure 1). It intersects twice with Duckpond Road (it not to be confused with Duckpond Bushland to the north off Banksia Road that forms part of Bush Forever Site 70).

Mundijong Road Reserve and Duckpond Reserve are treated as a single management unit in this plan unless otherwise indicated.

Interim Biogeographic Region of Australia: Swan Coastal Plain

CALM Region: Swan

CALM District: Swan Coastal

Shire: Serpentine-Jarrahdale.

Co-ordination Committee: to be established. Representatives will be sought from the Shire of Serpentine-Jarrahdale, Jarrahdale Land Conservation District Committee (LCDC), the Roadside Care Volunteers (RCV) and CALM.

Management Plan Objectives: To maintain and/or improve the overall condition of these reserves with particular emphasis on protecting the four threatened ecological communities and numerous species of Declared Rare Flora found therein, and to raise the community's awareness of the significance of the two reserves and support for their conservation.

Criteria for success:

- Mundijong Road and Duckpond Reserves are placed under conservation management.
- Maintenance in terms of diversity and basic composition of native species (as described in Gibson *et al.* 1994 and Department of Environmental Protection 1996) as well as hydrologic and biological processes, taking account of natural change over time.
- Improvement in terms of reduction of numbers of exotic species and of other threatening processes as defined in this plan.
- Maintenance or an increase in the strong local community involvement in management of the reserves.

Criteria for failure:

- Significant loss of area or increased modification of the reserves.
- Decline in involvement of the local community in the management of the reserves.

Summary of Management Actions-

1. Transfer the vesting of the unallocated remnant on Mundijong Road to the CCWA	10. Fence Duckpond Reserve and intersecting corners of Mundijong Road
2. Establish a Co-ordination Committee	11. Develop and implement a Drainage Management Strategy
3. Liaise with current management organisations, owners, land managers and other interested groups to implement recommendations held in the Management Plan	12. Manage dieback disease
4. Elevate the profile of Mundijong Road and Duckpond Reserves through signage	13. Develop and implement a monitoring program
5. Disseminate information about the reserves	14. Develop a Fire Management Strategy
6. Seek an alternative route for the equestrian trail	15. Remove existing rubbish from the reserves and implement measures that aim to reduce rubbish dumping
7. Map, assess and monitor weed populations	16. Establish a Multiple Use Corridor/Buffer Zone to the South of Mundijong Road Reserve
8. Implement weed control	17. Assess hydrological data and develop a Salinity Management Strategy
9. Undertake revegetation/rehabilitation	

BACKGROUND

History

Prior to European settlement the Aboriginal population of the south west appears to have been about 1000 to 1200 people. These were divided into smaller groups of about 20 to 30 people that were divided further into loose travelling family groups of six or seven. No records exist for a particular group of people who lived around the Mundijong area. People who lived near North Dandalup or another group living around the Rockingham area were probably the groups who lived closest to the site. Aborigines seemed to avoid the Darling Range, mostly as this area offered little in the way of food compared to the low lying plains (Richards 1978). Nomadic in habit, always travelling in search of food, it is very likely they roamed in the vicinity of Mundijong. At that time the general area was likely to be swampy and seasonally inundated. The land appeared to yield a plentiful harvest prior to the arrival of white man (Hammond 1933). However, examination of the literature indicates that by the end of the 1890s most of the original inhabitants were gone (Coy 1979; Richards 1978).

The existence of remnant vegetation along Mundijong Road can be attributed to the early timber milling industry at Jarrahdale. In 1872, a rail line was constructed from Jarrahdale's first saw mill to a newly built jetty at Rockingham. The land set aside and used for the railway is the present location of Mundijong Road Reserve. The last timber train went through in 1939 and the line soon fell into disrepair (pers comm. Ted Love¹). In 1950 the rails and sleepers were removed (Fall 1972) and the vegetation allowed to regenerate.

When Mundijong Road was originally constructed around 1930, Duckpond Reserve was severed from the rest of the area during the construction. Main Roads WA resumed Duckpond Reserve in the late 1950's and used it for a clay pit to reconstruct Mandurah Road. In the 1970's when the Birriga Bridge was constructed, and Mundijong Road again realigned, the clay pit was filled in with yellow sand from the Baldivis area. Since then a number of Government Departments have used Duckpond Reserve as a machinery depot, camp site and for superphosphate trials (pers comm. T. Love).

The management of Mundijong Road and Duckpond Reserves has been undertaken by the Shire of Serpentine-Jarrahdale and volunteer community members. In 1996 a comprehensive flora survey was conducted by B. Keighery (Keighery 1996) with a key recommendation from that report that the conservation values be recognised and formally protected. In 1997 negotiations about the future management of the site commenced between CALM, the Department of Land Administration and the Shire of Serpentine-Jarrahdale. In June 1999, following consultation with the community groups involved in the management of the reserves, the Serpentine-Jarrahdale Shire Council supported the transfer of the care, control and management of the reserves to the then National Parks and Nature Conservation Authority (now the Conservation Commission). The Council's support was conditional upon:

- A Memorandum of Understanding and Management Plan being prepared between the Shire, Land Conservation District Committee (LCDC), and CALM prior to the initiation of the transfer.
- The public recognition that the reserves will be jointly managed by the local community, Local Authority and CALM.
- CALM funding ongoing management of the reserves as required.

The intent of these conditions was to foster a partnership between the three key players in the management of the reserves (Del Marco 1999).

Conservation significance

The linear remnant on Mundijong Road (Figure 2) has very significant conservation values as it represents one of only two remaining transects of native vegetation that span the alluvial soils of the southern Swan Coastal Plain. The other remnant of this type occurs along the Wonnerup-Tutunup Road near Busselton (Gibson *et al.* 1994). Duckpond Reserve is also the only 'Boyanup' soil type with remnant vegetation remaining on the Swan Coastal Plain (pers comm. B. Gilkes²).

¹ Ted Love, Adjacent landowner Duckpond Road Reserve

² Bob Gilkes, Professor of Soil Science, University of Western Australia

The Mundijong Road remnant also contains two Critically Endangered communities and many significant flora (described below in Biological and ecological characteristics).

Description

The largest portion of the vegetation on Mundijong Road occurs within an unvested Government Requirements reserve. However the vegetation also occurs in two other reserves (refer Figure 3). The Management Plan applies to all three reserves as follows:

- a) Unvested Government Requirements Reserve number 23793 (total area 36.06 hectares)
- b) Water Corporation Drainage Reserve (20 metre wide corridor from Webb Rd to Kargotich Road)
- c) Mundijong Road Reserve, Local Government (two to three metre wide vegetated section on the south side of Mundijong Road from east of Duckpond Road to Wright Road)

The unvested status of the Governments Requirements reserve does not allow recognition of the significance of the vegetation or provide the area with adequate protection.

Mundijong Road is bounded to the south by private property, except for a Parks and Recreation reserve to the south east of Webb Road. This is managed by the Shire of Serpentine-Jarrahdale and leased to the Mundijong Thoroughbred Training Association. Cleared agricultural land surrounds the remnant vegetation on Mundijong Road.

Duckpond reserve, Lot 101 Mundijong Road, is a small (2.9112 hectare) remnant at the western end of Mundijong Road Flora Reserve on the northern side of Mundijong Road. Duckpond Road borders the reserve to the northeast and northwest. It is currently Unallocated Crown Land.

Land use within the reserves is as follows:

- A drainage reserve managed by Water Corporation, which includes a drain and drain maintenance access way.
- A road reserve utilised by Telstra, Main Roads Western Australia (MRWA), Western Power and other utility providers. A six pole power line runs through the centre of Duckpond Reserve.
- A public recreation/rest area near the corner of Mundijong and Paterson Roads. This area of approximately 0.5 hectares contains an information stand that depicts the conservation values and dieback issues, and has picnic tables. Bollards are in place to restrict access into the surrounding bush and a short trail leads into the vegetation.
- The surrounding land use of both reserves is predominately rural and rural living subdivision.

The condition of the vegetation ranges from completely degraded to excellent. Approximately 50% is classified as excellent to very good. A map of the vegetation complexes that occur in the reserves and condition ratings occurs in Figure 4. The map is reproduced from Keighery (1996).

Mundijong Road is a Flora Road. This designation is designed to increase public knowledge of the conservation values of particular road reserves.

Community Involvement

Mundijong Road and Duckpond Road Reserves have been managed by the Serpentine-Jarrahdale Land Conservation District Committee (LCDC) in collaboration with the Shire since 1995. This has been achieved through a significant input by the Roadside Care Volunteers (RCV) (a sub-committee of the LCDC), the Serpentine-Jarrahdale Land Care Centre, and officers and councillors of the Shire of Serpentine-Jarrahdale. It is most likely that the local community will wish to continue to have a significant role in management of Mundijong Road Reserve and Duckpond Reserve. Statutory Government Authorities and the Local Authority also have vested interests in the reserves.

A number of community projects have been completed in the area. An information stand was erected at the eastern end of Mundijong Road Reserve by Green Corps through the Serpentine-Jarrahdale Land Care Centre in partnership with the Shire of Serpentine-Jarrahdale. The local community in partnership with the Shire and Federal Government has, and is, undertaking active management of the reserve. Over \$10,000 has been spent on weed control, plant propagation, seed collection, dieback mapping, collection of plant specimens and the development of a flora road circuit. The gradual

removal of woody weeds, including *Casuarina glauca*, on Mundijong Road between Kargotich Road and Adonis Street, has been co-ordinated by the Serpentine-Jarrahdale Land Care Centre since 2000. Most of the weed control has been conducted by the RCV with assistance from the Land Care Centre's Bush Rehabilitation officer and the Shire's Environmental Officer. Particular emphasis has been given to the high conservation areas and the removal of *Watsonia* infestations between Paterson and King Road. As a consequence, the frequency and density of the *Watsonia* populations have been significantly reduced (pers comm. N. Scade³).

Biological and ecological characteristics

The reserves occur on sandy clay and wet clay. Land capability charts indicate that the soils are subject to water logging and susceptible to salinity. The reserve is a seasonally waterlogged palusplain containing a mosaic of wetland communities (Churchward and McArthur 1980; English and Blyth 2000a, b).

The vegetation along Mundijong Road is considered typical of the wet flats and slightly raised uplands of the Pinjarra Plain, these being:

Uplands – *Eucalyptus calophylla*, forest to woodland

Wet flats – *Eucalyptus calophylla* forest to woodland; *Casuarina obesa* forest to woodland; *Eucalyptus rudis* woodland to forest; *Melaleuca raphiophylla* woodland to forest; *Melaleuca* open heath to shrubland dominated by *Melaleuca viminea*, *M. uncinata*, *M. lateriflora* and combinations of these; *Actinostrobus pyramidalis* closed tall scrub to shrubland; *Viminaria juncea* high shrubland; *M. viminea* tall shrubland; *Pericalymma ellipticum* heath; *Regelia ciliata* heath; mixed low open heath; herblands dominated by *Borya* species, *Tribonanthes* species, *Stylidium* species and others in combination; sedgelands dominated by *Meeboldina cana*, *Chaetanthus aristatus*, *M. coangustata*, *Cyathochaeta avenacea*, *Chorizandra enodis* and combinations of these; *Themeda triandra* grassland (Keighery 1996; Keighery *et al.* 1997). 253 native plant taxa have been identified within the reserve (Keighery 1996, see Appendix 1).

Four threatened ecological communities occur within the reserve. The ecological communities were formally identified in a survey of the Swan Coastal Plain in 1994 (Gibson *et al.* 1994) and are discussed in English and Blyth (1997). They include:

- Floristic community type 3a; *Eucalyptus calophylla* – *Kingia australis* woodlands on heavy soil (ranked as Endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act), and Critically Endangered in WA); 81 hectares remaining, 1.2 hectares on Mundijong Road (1.5% of total area).
- Floristic community type 3c (*Eucalyptus calophylla* – *Xanthorrhoea preissii* woodlands and shrublands on heavy soil (ranked as Endangered under the EPBC Act, and Critically Endangered in WA); 72 hectares remaining, 3.6 hectares on Duckpond (5% of total area).
- Floristic community type 8; Herb rich shrublands in clay pans (ranked as Vulnerable in WA); 136 hectares of this community remains, Mundijong Rd occurrences (there are 2) total 3 hectares, representing 2.2% of the total area.
- Floristic community type 9; Dense shrublands on clay flats (ranked as Vulnerable in WA); 60.7 hectares remain, 0.2 hectares in Duckpond reserve (0.3% of total area).

Two flora listed as Declared Rare under the WA *Wildlife Conservation Act* 1950 occur in the reserve (see Appendix 2 for definitions). These are *Verticordia plumosa* var. *pleiobotrya* (ranked as Critically Endangered; Endangered under the EPBC Act) and *Tetraria australiensis* (ranked as Vulnerable; also Vulnerable under the EPBC Act). Five Priority taxa are also found within the reserve (Atkins 2003; Government of Western Australia; Keighery *et al.* 1997) including:

Acacia lasiocarpa var. *bracteolata* long peduncle variant (G.J.Keighery 5026) (Priority 1)

Baeckea tenuifolia (Priority 3)

Myriophyllum echinatum (Priority 3)

Stylidium longitubum (Priority 3)

Aponogeton hexatepalus (Priority 4)

Anthotium junciforme (Priority 4)

³ Nancy Scade, Jarrahdale Land Conservation District

Hydrology

As the reserves mainly occur on soils that contain an impervious clay layer, they become inundated or waterlogged in the wetter months due to rainfall and surface flows. In some areas the groundwater is also very close to the surface.

Low levels of salinity have been reported in the vicinity of Mundijong Road and Duckpond Reserve. Salinity levels of approximately 250 to more than 2,000 milligrams per litre total dissolved salts (mg/L TDS) were recorded for the superficial aquifers where the reserves occur. Levels of over 2,000 mg/L TDS were recorded for the shallow Leederville aquifer on Mundijong Road. In these areas, Guildford Clay soils inhibit the infiltration of rainfall and cause concentration of salts by evaporation (Davidson 1995).

Fauna

No specific fauna studies have been conducted in Mundijong Road or Duckpond Reserves. Bush Forever notes the occurrence of the Quenda (*Isoodon obesulus fusciventer*) (Government of Western Australia 2000). Anecdotal observations also include the Brushtail Possum (*Trichosurus vulpecula leucogaster*), and several bat species. The vegetation also supports large reptiles including snakes, and birdlife including feeding habitat for birds of prey (pers obs. A. Del Marco⁴ 1998-2001).

Threatening processes

Clearing

Clearing of heavy soils for agriculture has been extensive on the eastern side of the Swan Coastal Plain, with some 97% of all vegetation in the area cleared historically (Department of Conservation and Land Management 1990a; Keighery and Trudgen 1992). The marri dominated types on these heavy soils were probably some of the most common on this portion of the plain but are now very rare and are likely to be at least 90% cleared (Gibson *et al.* 1994). Future clearing is more likely to be associated with developments for road works, rural subdivisions and industry.

Road development

The population in the Shire of Serpentine-Jarrahdale is rapidly increasing and is predicted to continue for at least the next ten years. Future developments, including the construction, upgrading and widening of local roads, will place pressure on the road reserves. In particular:

- Widening of Mundijong Road. - Metropolitan Regional Scheme Amendment 991/33 (MRS 991/33). An existing Controlled Access Highways (CAH) reservation between Lightbody Road and the future Kwinana Highway (originally established in 1963 and called the Peel Deviation) was modified in December 1995 to follow the existing alignment of Mundijong Road. The proposal is to upgrade Mundijong Road to a four lane divided road with controlled frontage and side access roads. At Duckpond Road the road will deviate to the south of the remnant vegetation before resuming an alignment along the existing Mundijong Road to the future Kwinana Freeway exchange. Proposals suggesting alternate routes to the north through land already cleared were rejected on the basis of being cost prohibitive (Western Australian Planning Commission 2000). The implementation date for the proposal is yet to be announced. An amendment report to MRS 991/33 (December 1998) states:

“Proposal 19: Except for the Duckpond Road area, the concept provides for construction of a second carriageway on the north side of the existing road. Side roads will be connected to Mundijong Road with at-grade T-junctions. Existing land uses will be served by direct access onto Mundijong Road, while future land use planning should be based on minimising additional direct access points.

The proposed design generally requires widening of the existing road reserve to a nominal 40 metres in width, which is similar to other east-west routes in this locality. This additional land requirement is not expected to have significant social and land use impacts, given the rural and semi-rural character of land in the area.”

⁴ Andrew Del Marco, Previously Environmental Officer, Shire of Serpentine - Jarrahdale

Liaison with MRWA and their contractors will be important in ensuring areas of high conservation significance are protected.

- The Tonkin Highway Southern Extension from Gosnells to Mundijong. The footprint of the road crossover proposed to connect the two-lane single carriageway of Tonkin Highway with Mundijong Road near Webb Road, is estimated to remove 0.2 hectares of remnant vegetation. Construction of the intersection may put at risk an area of high quality vegetation and increase the risk of the introduction of disease into the bushland.

Extensive negotiation has occurred between MRWA, CALM, and the Environmental Protection Authority (EPA) on the Tonkin Highway upgrade. EPA Bulletin 952 for MRS Amendment 991/33 in 1999 and EPA Bulletin 1043 in 2002 outline requirements for the proponent (MRWA) to comply with prior to construction. They include commitments to prepare:

1. A Design and Construction Environmental Management Plan
 2. Landscape and Revegetation Strategy Plan and Management Plan
 3. Vegetation Mitigation Strategy
 4. Provision for fauna crossings
 5. Wetland Mitigation Strategy
- Access to properties to the south of Mundijong Road. Future subdivisions may seek to cross the road reserve directly from Mundijong Road. Several unofficial tracks exist already where property owners have cut through the vegetation to access the back of their paddocks.

Several other tracks occur through the reserves. Namely:

- A drain maintenance access point, near Kargotich Road.
- Old drain maintenance point, near Webb Road.
- Walking trail accessed from the rest area.
- Unofficial bridle trail running through the middle of remnant vegetation from east of Webb Road towards Mundijong township.

Road maintenance

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

Road maintenance activities for Mundijong Road are coordinated by the Shire of Serpentine-Jarrahdale. The Shire is aware of the conservation value of the vegetation on the south side of Mundijong Road. Rarely, one width may be cut with a slasher. The Shire has sensitive area maps that are checked to prior to any operation (pers comm. P. Beaumont⁵).

Weed invasion

Disturbances such as clearing, fire and grazing increase weed invasion. The weeds of Mundijong Road and Duckpond Reserves were identified (Appendix 1) and their distribution mapped by Keighery in 1996 (Appendix 3). A more detailed map will need to be prepared to reflect the current status.

Principal weed species include:

1) Uplands/Marri woodlands

Eragrostis curvula (African lovegrass), *Ehrharta calycina* (Perennial veldt grass), *Pennisetum clandestinum* (Kikuyu), *Avena fatua* (Wild oat), *Briza maxima* (Blowfly grass) and *Watsonia* species

2) Wet flats/heaths

Eragrostis curvula (African lovegrass), *Gladiolus angustus* (Long tubed painted lady), *Sparaxis bulbifera*, *Babiana angustifolia* (Baboon flower) and *Watsonia* species

⁵ Paul Beaumont, Shire of Serpentine – Jarrahdale Parks and Gardens Manager

3) Verges and cleared areas

Eragrostis curvula (African lovegrass), and occasional occurrences of *Arundo donax* (Giant reed)

Agricultural weeds are also establishing throughout the reserves. *Moraea flaccida* (Cape Tulip), *Asparagus asparagoides* (Bridal Creeper), *Echium plantagineum* (Paterson's curse), and *Euphorbia terracina* (Geraldton carnation weed) have been observed. Small spot outbreaks of bridal creeper (*Asparagus asparagoides*), are already known to occur between Webb and Kargotich Road.

In 1996, Keighery also identified a series of woody weeds planted in the reserve, the majority of which are known to be potentially invasive. These include *Melaleuca viminalis*, *Eucalyptus platypus*, *Agonis flexuosa*, *Hakea laurina*, *Melaleuca nesophila* and *Acacia longifolia*. *Eucalyptus camaldulensis*, *Casuarina glauca* and *C. cunninghamiana* have also been recorded (Keighery 1996).

Due to the size, shape and location of the reserves next to pastures, they are very vulnerable to weed invasion following any disturbance. However, even small remnants often exhibit surprising resistance to weed invasion, particularly if left undisturbed. In these reserves, such resistance relates to the density of vegetation cover, seasonal inundation and the hardness of the soils in summer. Alteration of any of these factors reduces the ability to resist weed invasion (Keighery 1996). The tracks intersecting the bushland are weed infested to varying degrees.

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

1. Accurately mapping the boundaries of weed populations. Keighery (1996) provides a useful base plan.
2. Selecting an appropriate herbicide or other method of weed control after determining which weeds are present (refer to Brown and Brooks 2003).
3. Controlling weeds that pose the greatest threat to the reserves in the early stages of invasion where possible, eg, invasive perennial grasses and *Watsonia*.
4. Rehabilitation through reintroduction of local native species where areas are no longer capable of regenerating following weed control.
5. Establishing monitoring/photo points to compliment the weed mapping.

Hydrological changes

The hydrology of specific areas of the eastern side of the Swan Coastal Plain has been altered through the construction of drains to lower the water-table (Keighery and Trudgen 1992). The area is characterised by much valued heavy soils, which were historically highly cleared for agriculture. Despite a likely increase in runoff and recharge of the groundwater resulting from this clearing, drainage has probably brought about an overall lowering of the watertable in localised areas (pers comm. B. Keighery⁶). Altered surface flow and/or alteration of the height of the local watertable may change the length of the period or the depth of any inundation (English 2000a).

A drainage reserve runs parallel to Mundijong Road and is included in the management area referred to as Mundijong Road Reserve. The eastern portion of the drain running along Mundijong Road is part of the Oaklands Sub B drainage system, which feeds into the main drain along Mundijong Road north of Kargotich Road. The reserve is 20 metres wide including the drainage channel and access track. The drain running along the eastern boundary of Duckpond Reserve is part of the Birrega Main Drain (Figure 5).

The drains were established in the past to augment the river systems and /or divert the river system from where they would naturally flow. All drains flow toward the Serpentine River and are discharged into Amarillo Lake. The purpose of the drains is upstream and adjacent land flood mitigation. The management of these drains is the responsibility of the Water Corporation under the Land Drainage

⁶ Bronwen Keighery, Department of Environmental Protection

Act (1925). At present, maintenance of the drains is funded by the State Government as a Community Service Obligation. The drains are inspected on a regular basis by Water Corporation staff. The Water Corporation has been instructed that the Department of Environment must be notified prior to any proposed maintenance of the drainage reserve between Paterson and Kargotich Road (pers comm. A. Del Marco). The last known occasion where the Corporation carried out maintenance works in the drain reserve was in the mid 1990. When maintenance occurs, the inverts (the sides of the drain) are cleaned out and the spill is placed on the bank of the drain at approximately four metres from the edge of the drain. In the past, the debris has been placed onto the remnant vegetation. As well as disturbing the vegetation, this exacerbates weed invasion. Initial inspection indicates that it may be possible to have the maintenance track and debris piles placed on the opposite side of the reserve between the channel and private property fence, thereby effectively increasing the width of the vegetated road reserve.

The depth of the Mundijong Road drain is over four metres. At the height of winter the water runs strongly and in certain wet seasons the drain has been observed to fill (pers comm. N. Scade). The velocity and volume of the water passing along this waterway could deepen the drain, the result potentially being a heightened safety risk, collapse of the inverts and/or an attrition of the reserve. Retention of vegetation on the drain embankments is important to prevent scouring and erosion during peak flow events.

A spoon drain up to one metre deep surrounds Duckpond Reserve.

Salinisation

Salinity levels of 250 - 2,000 mg/L TDS have been recorded where the reserves occur (Davidson 1995). Salinisation may increase as a result of evaporation of surface water, especially where saline superficial aquifers are in contact with the surface. If increased inundation occurs in or near the reserves due to urbanisation or clearing in the catchment, evaporation of a greater volume of water may result in larger amounts of residual salt. This is especially true for clay soils, which inhibit rainfall infiltration and result in high evaporation rates and concentration of salts (Davidson 1995). Mundijong Road reserve may be under threat of salinisation in future if water-tables rise as a result of urbanisation or other causes.

Grazing and trampling by horses

The equine establishment is a major contributor to the lifestyle of the Shire of Serpentine-Jarrahdale. Low levels of horse riders are using the road reserve, rather than the busy Mundijong Road, for access to the Webb Road Horse Track facility. Several informal bridle trails are becoming established within the bushland area. Horse riding and other non passive recreational activities exacerbate the deterioration of the bushland through:

- Spread of disease
- Spread of weeds
- Trampling of vegetation

The Shire of Serpentine-Jarrahdale is currently developing local policies that address 'Multiple Use Trails' within its jurisdiction (Planning Policy no. 9). The Mundijong and Webb Road intersection is considered in the area identified as 'Precinct 9'. A potential trail runs along the south side of the reserve on Mundijong Road. The draft policy also states:

“Nothing in this Policy is intended to contravene, contradict or diminish existing statutory responsibilities of State Governments Departments, Local Government Authorities or other authorised managers. Further, no recreation trail proposed in this Plan will be planned, constructed, upgraded or registered (in the State Trails Register) without the express permission/agreement of the relevant land manager” (Shire of Serpentine-Jarrahdale 2002a).

Disease

Dieback caused by *Phytophthora* species has the potential to impact on the reserves. Plant communities that occur on heavy soils such as within these reserves, especially in relatively flat areas, are generally not highly susceptible to *Phytophthora* (Helyar 1994). However in February 1999,

Glevan Dieback Consultancy Services⁷ concluded that Mundijong Road Reserve had a high level of *Phytophthora* infestations. Duckpond Reserve was found to be dieback free (Tuffnell and Brown 1999) (Figure 6 previous page).

The major threat to the remaining sections of disease free vegetation is unhygienic access and the risk of introducing infected soil/water into these sites. In particular, access and maintenance of the drainage channel that runs through the majority of the Mundijong Road reserve has the potential to spread or exacerbate disease. Dieback disease will also spread naturally, albeit slowly, through root to root contact, and through the surface and ground waters (Department of Conservation and Land Management 1990b).

Several small areas of Mundijong Road reserve were sprayed with the chemical Phosphite to help protect the dieback free areas from infestation. Follow up spraying and monitoring has not yet occurred.

Size and Shape

Mundijong Road Reserve runs directly east – west. Its northern boundary abuts Mundijong Road and its southern boundary abuts mostly cleared farmland on private property (refer to Figure 1). The width of the reserve varies from 25 metres to 45 metres (including the Water Corporation drainage reserve). The narrow, linear nature of the reserve makes it particularly vulnerable to weed invasion and impacts of recreation users, agricultural activities and future urban or semirural developments.

Altered fire regimes

Mediterranean ecosystems are usually well adapted to fire and indeed may require a particular fire regime to assist regeneration. If an appropriate frequency of fire 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 unable to regenerate. Therefore, fires must occur at appropriate intervals and possibly at the appropriate season and intensity to maintain the integrity of plant communities.

Fires increase the risk of weed invasion by removing the dense shrub, herb and sedge strata. Grassy weeds increase fire hazard due to higher flammability. A fire which occurred in 1997/1998 near the Webb Road Racecourse, escaped into a 0.5 hectare portion of Mundijong Flora Road Reserve.

Other human usage

The most significant degrading process identified by Keighery (1996) is localised clearing by utility providers. Ongoing maintenance of electric wire poles and underground services has resulted in soil disturbance, a decline in the soil structure, and weed invasion. In particular in Duckpond Reserve a power line runs through the middle of the reserve (pole numbers 63862 to 63857). During maintenance, vegetation underneath the power poles is cleared. This not only disturbs the vegetation but has also exacerbates weed invasion into the adjacent areas. Environmental Sensitive Area signs have been affixed to power poles to encourage care to be taken by maintenance operators. CALM staff are also currently liaising with Western Power to develop a strategy for managing the powerlines within this reserve in the future.

A small to moderate level of unauthorised dumping of rubbish, such as household rubbish, car parts and garden waste, has occurred along Mundijong Road and within Duckpond Reserve. Apart from spoiling the visual appeal of the area this practice has the potential to introduce weeds, crush sensitive vegetation and reduce the sense of community ownership.

The inappropriate placement of signs, the large number of notices has also spoiled the visual appeal of the area.

⁷ Accredited dieback interpreters from CALM

Feral Animal Activity

Rabbits (*Oryctolagus cuniculus*) occur in the reserves and may have an impact through increased nutrient levels from their droppings and the introduction of weeds. Foxes (*Vulpes vulpes*) have been observed to live in holes in drain spoil within the reserves and will predate on native fauna that occurs in the reserves.

Strategies for Management

- Identify management issues and influence the future management of Mundijong Road and Duckpond Reserves so as to maintain their natural biological and non biological attributes and enhance the protection of the threatened ecological communities and Declared Rare Flora that occur in the reserves.
- Maintain and nurture the 'sense of ownership' and involvement of the local community.
- Develop a partnership arrangement between the Serpentine-Jarrahdale Shire and CALM.

MANAGEMENT OBJECTIVE AND CRITERIA

Aim

To maintain or improve the overall condition of the remnant vegetation on Mundijong Road Reserve and Duckpond Reserve.

Criteria for success:

- Mundijong Road and Duckpond Reserves are placed under conservation management.
- Maintenance in terms of diversity and basic composition of native species (as described in Gibson *et al.* 1994 and Department of Environmental Protection 1996) as well as hydrologic and biological processes, taking account of natural change of the reserves over time.
- Improvement in terms of reduction of numbers of exotic species and of other threatening processes as defined above.
- Maintenance or an increase of the strong local community ownership and involvement.

Criteria for failure:

- Significant loss of area or further modification of the reserves.
- Decline in involvement of the local community in the management of the reserves.

MANAGEMENT ACTIONS

Note 1. The responsible authority is frequently listed as the relevant CALM District. This refers largely to initiating and guiding actions. However, due to the complex nature of these reserves and the many agencies/individuals involved in its management, the relevant CALM District, the Western Australian Threatened Species and Communities Unit (WATSCU), the Shire and the Co-ordination Committee (i.e. the local community) share the primary responsibility for identifying funding sources and securing funds for management actions.

Note 2. These actions are listed in the approximate order in which their implementation will begin.

Note 3. Where appropriate, the completion date for actions is given as year 1, 2, 3, 4 or year 5 meaning the years for which the Management Plan operates.

Note 4. Wherever applicable the Management Plan is to be implemented in conjunction with other associated management plans already written. Namely:

- English and Blyth (2000a)

- English and Blyth (2000b)
- Shire of Serpentine-Jarrahdale (2002)
- Evans *et al.* (Draft).

Note 5. In addition to the above, other management commitments exist for Mundijong Road and should be taken into consideration when implementing the plan. In particular, MRWA's:

- Design and Construction Environmental Management Plan – Tonkin Highway Extension from Mills Road West Gosnells to the South Western Highway, Mundijong (in preparation).
- Landscape and Revegetation Strategy Plan (in preparation).
- Vegetation Mitigation Strategy (in preparation).

1. Transfer the vesting of the unallocated remnant on Mundijong Road to the Conservation Commission of Western Australia

To ensure the long term protection of the unvested reserves (unofficially managed by the Shire of Serpentine-Jarrahdale) it is considered necessary for the following areas to be under the care, control and management of the Conservation Commission of Western Australia as an A class reserve for the purpose of 'Conservation of Flora and Fauna':

- Government Requirements Reserve number 23793 (total area 36.06 ha)
- Lot 101 Mundijong Road (total area 2.9112 ha) Duckpond Reserve

The care, control and management of the Drainage Reserve (20 m wide corridor from Webb to Kargotich Road) will remain with the Water Corporation.

Responsibility: CALM (Land Administration Section); Shire of Serpentine-Jarrahdale; DOLA
Cost: \$5,000 for all liaison (not including vehicle costs)
Completion date: Year 1

2. Establish a Co-ordination Committee

Due to the small size and linear shape of the reserves and their proximity to rural and future urban development in the long-term, active involvement in the management of the reserves will be necessary. For management to be successful a partnership arrangement between all stakeholders will be required. A Co-ordination Committee will be established to coordinate the management of the reserves. This committee will include but not be limited to:

- Serpentine-Jarrahdale RCV
- Serpentine-Jarrahdale LCDC
- Shire of Serpentine-Jarrahdale
- CALM
- Main Roads Western Australia
- Water Corporation
- Serpentine-Jarrahdale Volunteer Fire Brigade

Responsibility: CALM (Swan Coastal District; WATSCU)
Cost: \$2,000 per year to run team
Completion date: Year 1

3. Liaise with current management bodies, owners, land managers and other interested groups to implement Management Plan

The involvement of CALM, the Shire of Serpentine-Jarrahdale, the Serpentine-Jarrahdale LCDC, local community groups, neighbouring landholders, and other government agencies such as MRWA, Water Corporation and Western Power, wherever possible and practical is essential to effectively manage the reserves. Other stakeholders should be consulted on management of the reserves as they are identified.

Responsibility: CALM (Swan Coastal District; WATSCU), Shire of Serpentine-Jarrahdale
Cost: Costs of liaison included as part of recovery action 1

Completion date: Ongoing

4. Raise public awareness of Mundijong Road and Duckpond Reserves through signage

Placing nature reserve signs along Mundijong Road and around Duckpond Reserve will raise public awareness that the bushland adjacent to the road is dedicated to nature conservation. This increased awareness has the potential to:

- Increase community awareness and encourage new volunteers
- Reduce incidental damage
- Reduce vandalism

Wooden routed CALM area identification signs used for nature reserves, that indicate the name of the location and include several symbols, will be placed at either end of reserves and at the corners of each road junction. Other strategic placements may be necessary.

All signage installed will recognise that the reserve is managed in partnership with community and Council.

Responsibility: CALM (Swan Coastal District)

Cost: \$3,500

Completion date: Year 1

5. Disseminate information about the reserves

To prevent accidental destruction of the bushland, and gain public support for its conservation, information about Mundijong Road and Duckpond Reserves will be provided to all stakeholders. An A4 poster which depicts the two threatened woodland communities has already been produced and distributed. The posters provide a description, approximate locations, threats and recovery actions that are underway. Information provided will compliment the brochure already developed by the Serpentine-Jarrahdale RCV Committee.

Ongoing articles in the local media about the progress and issues pertaining to the reserves, such as volunteer involvement, will encourage awareness.

Responsibility: CALM (Corporate Relations Division; Swan Coastal District; WATSCU), Shire of Serpentine-Jarrahdale

Cost: \$1,000 per year

Completion date: Ongoing

6. Seek an alternative route for the equestrian trail

An alternative route will be sought for horse riders away from areas of high conservation value in the Mundijong Road reserve. A buffer strip which includes a trail will be sought (see recovery action 16) outside of the reserve. This buffer strip should also be built into any future subdivisions along Mundijong Road. Where not possible, the existing drainage access track could be utilised. CALM will also seek early input into the development of the Shires Multiple Use Trails policy.

Responsibility: CALM; Shire of Serpentine-Jarrahdale, RCV, Community groups

Cost: Costs of liaison included as part of recovery action 1

Completion date: Year 1

7. Map, assess and monitor weed populations

Weed populations will be accurately mapped and appropriate herbicides or other methods of weed control determined. The community groups and the Shire of Serpentine-Jarrahdale have a great deal of local knowledge on the weed species present in the reserves and appropriate control methods. Floristic data from Keighery and Trudgen (1992), Gibson *et al.* (1994), Keighery *et al.* (1996) and other reports on individual areas, provide information on weed species present. Keighery (1996) also contains a base map that identifies vegetation types along Mundijong Road.

Responsibility: CALM (Swan Coastal District) in consultation with landowners, Shire of Serpentine-Jarrahdale and local community groups
Cost: Mapping of the boundaries of weeds species that are high priority for control - \$3,000 every two years.
Completion date: Ongoing

8. Implement weed control

Initial stages of rehabilitation will involve controlling environmental weeds in reserves or zones with the highest conservation value. Within each reserve weed control will begin in areas in best condition and work towards the most degraded bushland as per the Bradley Method of Bushland Restoration (Buchanan 1989). Piles of soil scraped from tracks act as a weeds source and will be removed. Bare areas created through soil or weed removal will be revegetated.

Professional contractors will be required to work with CALM and community groups to implement the intense weed control that will be necessary.

Responsibility: CALM (Swan Coastal District) in consultation with landowners, Shire of Serpentine-Jarrahdale and local community groups
Cost: \$2,000 per year for weed control
Completion date: Ongoing

9. Undertake revegetation/rehabilitation

Rehabilitation through reintroduction of local native species may be necessary if areas are no longer capable of regenerating. Only seed collected from the same or closest source will be used for rehabilitation. Planning will allow for weed control, time for regeneration, monitoring, additional weed control as required, and further regeneration and monitoring until the site has reached the desired condition (Del Marco and Moore 2000).

The Duckpond Reserve fire breaks will be allowed to revegetate naturally as the surrounding roads provide suitable fire breaks and access tracks.

It may be necessary to replant with deep rooted vegetation in strategic parts of the catchment if monitoring indicates salinisation is a problem.

Responsibility: CALM (Swan Coastal District) in consultation with landowners, Shire of Serpentine-Jarrahdale and local community groups
Cost: \$3,000 per year
Completion date: Ongoing

10. Fence Duckpond Reserve and intersecting corners of Mundijong Road

Duckpond Reserve will be fenced to help protect it from vandalism, rubbish dumping and damage by vehicles. The fence will include two large gates for emergency vehicle access, and pedestrian gates. The possibility of erecting the fence on the road side of the drain system to prevent further attrition of vegetation will be investigated.

Where vegetation damage occurs as a result of the cutting of corners by vehicles turning off Mundijong Road, the road corners will be fenced or bollards erected.

Responsibility: CALM (Swan Coastal District), Shire Serpentine-Jarrahdale
Cost: \$2,500
Completion date: Year 1

11. Develop and implement a Drainage Management Strategy

A drainage maintenance and rehabilitation strategy will be developed and implemented in liaison with the Water Corporation and the Serpentine-Jarrahdale Shire for the drains adjacent to Mundijong Road and Duckpond Reserve. The strategy will include:

- The establishment of a drain maintenance track for the drainage channel between the channel and private property fence to allow the existing track to revegetate. This would increase the width of the reserve and reduce the risk of disturbance and weed invasion during future drain maintenance activities.
- Streamlining the banks of the drains. Weed growth in water channels and wetlands can be reduced (but not eliminated), by planting the edges with local provenance trees and tall shrubs. For east-west waterways, planting on the north side will maximize shade over the water and this will help to prevent weed growth. Care will be taken to ensure the plantings do not encroach into remnant vegetation.
- Re-directing water runoff away from Mundijong Road to reduce the water flow and potential invert breakdown. This action will reduce the level of maintenance and risk of vegetation damage at Mundijong Rd and potentially widen the reserve area.
- Rationalisation and closure of any drainage channels not deemed necessary (ie. drainage channel surrounding Duckpond Road Reserve).

Responsibility: CALM (Swan Coastal District), Water Corporation, Shire of Serpentine-Jarrahdale

Cost: Cost of liaison included as part of recovery action 1; cost of implementation to be determined

Completion date: Strategy to be developed in Year 1; implementation ongoing

12. Manage dieback disease

Dieback has been identified in Mundijong Road Reserve but not in Duckpond Reserve. Priority areas for dieback treatment will be determined from the Dieback Protocol that is currently being prepared by CALM. Data on dieback presence and impact, and future biodiversity implications, such as the loss or decline of Declared Rare Flora, Priority taxa, threatened ecological communities and structurally or functionally important taxa, are likely to be important determinants of the priority of treatment.

An awareness program about appropriate hygiene procedures that targets all users of the reserve is necessary. Hygiene procedures will involve the wash down of any equipment used on the reserves, and restricting access by vehicles and machinery to dry soil conditions (Tuffnell and Brown 1999).

The effectiveness of previous phosphite application will be recorded and outcomes monitored. Phosphite will be reapplied as indicated by monitoring.

Responsibility: CALM (Swan Coastal District) in consultation with Shire of Serpentine-Jarrahdale

Cost: \$2,500 per year

Completion date: Ongoing

13. Develop and implement a monitoring program

The reserves' condition and social environment will be considered in design of a monitoring program. Public recognition of success will be an important outcome of the monitoring program.

Line intercept and photographic methods, as described in Hopkins *et al.* (1987), as well as using permanent plots already in place from other surveys (Gibson *et al.* 1994; Keighery *et al.* 1996), will be utilised to monitor vegetation condition and floristics. Weed levels, plant species diversity, fauna, dieback and community involvement will be monitored. The impact of feral animals will also be monitored and a control program implemented if necessary. Table 1 is a monitoring schedule that could be maintained by the Roadside Volunteers Group. Shire of Serpentine-Jarrahdale staff drive along Mundijong Road frequently and opportunistic observations will be included in the monitoring program.

Table 1. Monitoring schedule for Mundijong Road and Duckpond Reserves

No.	Aspect	Responsible organisation	Method	Frequency
1	Dieback	CALM/RCV	Survey	Every three years
2	Fire	CALM/RCV	Survey	Annually
3	Salinity	CALM/RCV/LCDC	To be determined	To be determined
4	Restoration and weed control	CALM/RCV	Marked quadrats and transects. Weed mapping	Annually
5	Flora surveys	CALM/RCV	Survey	Annually for DRF & TECs, every 3 years for floristics in Gibson <i>et al</i> (1994) plots
6	People use/community involvement	CALM/RCV	Observations/questionnaires	Every three years
7	Rehabilitation	CALM/RCV	Photo points/quadrats	Annually

Responsibility: CALM (Swan Coastal District), in consultation with community groups

Cost: \$5,000 per year

Completion date: Ongoing

14. Develop a Fire Management Strategy

14.1 Develop and implement a Fire Management Strategy

Due to the high conservation value, historical fires, and the likelihood of unplanned fire a policy of no planned burning will be implemented for the life of this Management Plan, unless results of monitoring suggest burning is necessary. Mundijong Road Reserve is beside an increasingly busy road and Duckpond Reserve is small and isolated, therefore they are both vulnerable to arson and/or accidental fires. Even in the absence of planned burns, fires are very likely to occur.

A Fire Management Strategy will be developed by CALM in liaison with the WA Fire and Emergency Services Authority (FESA) and the Shire of Serpentine-Jarrahdale. The strategy will include advice on where and how a fire should be controlled, firebreak maintenance and construction, dieback hygiene and fuel and weed monitoring. The strategy will also address fuel loadings on roadsides, drains and adjacent properties, and will include an annual fire monitoring and reporting schedule.

Responsibility: CALM (Swan Coastal District) in consultation with landowners and FESA, Shire of Serpentine-Jarrahdale

Cost: \$1,000 to develop, \$500 per year to implement

Completion date: Strategy to be completed in Year 1

14.2 Rationalise and maintain strategic fire-breaks

The need for existing firebreaks will be examined as they are likely to exacerbate the spread or intensification of dieback, weed invasion, or otherwise degrade the reserves.

Alternative firebreak locations on adjacent lands, and/or methods of constructing firebreaks such as slashing will be sought.

Responsibility: CALM (Swan Coastal District); in liaison with surrounding landholders FESA, Shire of Serpentine-Jarrahdale.

Cost: Cost of liaison included as part of recovery action 1; cost of weed control included under recovery action 8

Completion date: Ongoing

14.3 Ensure fire suppression actions do not impact the reserves

It is important to ensure that fire-fighting authorities recognise the importance of not constructing new tracks during their operations, including during wildfires. Due to the conservation significance of the reserves, chemicals that may be toxic to the vegetation such as fire suppressants, will not be used. Guidelines for appropriate fire suppression actions will be developed. A local CALM staff member with knowledge of the reserves will be present during wildfires and controlled burns in the reserves to advise on protecting the conservation values. If a fire occurs in the reserves clean up activities will follow. This will include track rehabilitation, weed control and rubbish removal as required.

Responsibility: CALM (Swan Coastal District) in consultation with landowners, FESA, Shire of Serpentine-Jarrahdale.

Cost: \$500 per year

Completion date: Ongoing

15. Remove existing rubbish from the reserves and implement measures to reduce rubbish dumping

Any rubbish, including a clay dump at the eastern end of Duckpond Reserve, found in the reserves will be removed immediately to discourage further dumping. Signs will be installed at Duckpond Reserve that indicate its high conservation value and state that dumping is illegal. The public will also be informed about the conservation significance of the site through the local media.

Responsibility: CALM (Swan Coastal District), Shire Serpentine-Jarrahdale

Cost: \$500 per year

Completion date: Year 1

16. Establish a Multiple Use Corridor/Buffer Zone to the South of Mundijong Road Reserve

A buffer of reserved land around the reserve will be sought. Such a buffer strip could be developed as a multi use corridor to be used by horse riders, walkers and cyclists. The buffer strip could then be fenced and partially revegetated with local native species, with consideration being given to the requirements of trail users. Any future sub-division adjacent to the reserve will incorporate this wildlife/corridor strip.

It is particularly important that a buffer be considered on the boundary of the land presently managed by the Shire of Serpentine-Jarrahdale, from Webb Road towards Kargotich Road, currently used by the Thoroughbred Association. Several structures have been erected close to the northern boundary fence and these may obstruct the process of dedicating land towards a buffer strip. If the Shire was to create a buffer strip on Shire-managed land, this may set a positive precedent for neighbouring landholders. Table 2 lists the land tenure adjacent to Mundijong Road.

Table 2. Property locations on the southern boundary of Mundijong Road Reserve

Property location	Land Use	Zoning	Property Location	Zoning
• Cockburn Loc 499	Private Property	Rural – Mundijong farmlet policy area (can be subdivided to 4 ha lots)	• Lot 30, Plan 3269	Rural
• R2166 Serpentine AA 94	Shire Reserve	Parks & recreation	• Lot 32, Diagram 29007	Rural
• Lot 3, Plan 22441	Private Property	Farmlet (no further subdivision permitted)	• Lot 123, Diagram 7171	Rural
• Lot 32, Plan 22441	Private Property	Farmlet	• Lot 0, Diagram 5715	Rural
• Lot 31, Plan 22441	Private Property	Farmlet	• Lot 22, Diagram 89954	Rural
• Lot 29, Plan 3269	Private Property	Rural	• Lot 21, Diagram 89954	Rural

Responsibility: CALM; Shire of Serpentine-Jarrahdale
Cost: Cost of liaison included as part of recovery action 1; cost of implementation to be determined
Completion date: Ongoing

17. Assess hydrological data and develop a Salinity Management Strategy

Mundijong Road reserve may be at risk from increased salinisation due to rising groundwater and/or increased inundation, as a result of clearing of the catchments. It is important to understand the degree of threat posed by salinity, as this will influence future management.

Groundwater levels and quality are routinely monitored by the Water and Rivers Commission (WRC) (and in specific areas by Agriculture Western Australia and local LCDCs). Data in Davidson (1995) suggests Duckpond Reserve, in particular, may be at risk from hydrological changes. Information for areas close to this community will be assessed.

Responsibility: CALM (Swan Coastal District) in liaison with WRC, Agriculture Western Australia and LCDCs
Cost: \$500 per year
Completion date: Ongoing

TERM OF PLAN

The management plan will operate from March 2004 to February 2009 but will remain in force until withdrawn or replaced.

Table 3. Summary of responsibilities*

Action	Responsibility	Completion date
1. Transfer Unallocated Crown Land to Conservation Commission	CALM, Shire of Serpentine-Jarrahdale, DOLA	Year 1
2. Establish a Co-ordination Committee	CALM, WATSCU	Year 1
3. Liaise with current management/bodies/owners/land managers	CALM, Shire of Serpentine-Jarrahdale	Ongoing
4. Elevate profile through signage	CALM	Year 1
5. Disseminate information about the reserves	CALM, Shire of Serpentine-Jarrahdale	Ongoing
6. Seek an alternative route for the equestrian trail	CALM, Shire of Serpentine-Jarrahdale, RCV, community groups	Year 1
7. Map, assess and monitor weed populations	CALM, Shire of Serpentine-Jarrahdale, community groups	Ongoing
8. Implement weed control	CALM, Shire of Serpentine-Jarrahdale, community groups	Ongoing
9. Undertake revegetation/rehabilitation	CALM, Shire of Serpentine-Jarrahdale, community groups	Ongoing
10. Fence Duckpond Reserve and intersecting corners of Mundijong Rd	CALM, Shire of Serpentine-Jarrahdale	Year 1
11. Develop and implement a Drainage Management Strategy	CALM, Water Corporation, Shire of Serpentine-Jarrahdale	Ongoing
12. Manage dieback disease	CALM, Shire of Serpentine-Jarrahdale	Ongoing
13. Develop and implement a monitoring program	CALM, community groups	Ongoing
14. Develop a Fire Management Strategy	CALM, Shire of Serpentine-Jarrahdale	Ongoing
15. Remove and prevent rubbish dumping	CALM, Shire of Serpentine-Jarrahdale	Year 1
16. Establish multiple use corridor/buffer zone	CALM, Shire of Serpentine-Jarrahdale	Ongoing
17. Assess hydrological data	CALM, Water and Rivers Commission, Agriculture WA, LCDCs	Ongoing

*Responsibility refers to the principal organisation responsible for ensuring the management action is completed, and additional support organisations.

The foundation of the management of the reserve is through a partnership between CALM, the Shire of Serpentine-Jarrahdale and the local community (refer to Del Marco 1999).

Table 4. Summary of costs for each management action

Management Action	Year 1	Year 2	Year 3	Year 4	Year 5
1. Transfer Unallocated Crown Land to Conservation Commission	\$5000				
2. Establish Co-ordination Committee	\$2000	\$2000	\$2000	\$2000	\$2000
3. Liaise with landholders/management bodies/managers	Costs of liaison included as part of recovery action 1				
4. Elevate profile through signage	\$3500				
5. Disseminate information about the reserves	\$1000	\$1000	\$1000	\$1000	\$1000
6. Seek an alternative route for the equestrian trail					
7. Map, assess and monitor weeds populations	\$3000		\$3000		\$3000
8. Implement weed control	\$2000	\$2000	\$2000	\$2000	\$2000
9. Undertake revegetation/rehabilitation	\$3000	\$3000	\$3000	\$3000	\$3000
10. Fence Duckpond Reserve and intersecting road corners of Mundijong Road	\$2500				
11. Develop and implement a Drainage Management Strategy	To be determined				
12. Manage dieback disease	\$2500	\$2500	\$2500	\$2500	\$2500
13. Develop and implement a monitoring program	\$5000	\$5000	\$5000	\$5000	\$5000
14. Develop a Fire Management Strategy	\$2000	\$2000	\$2000	\$2000	\$2000
15. Remove and prevent rubbish dumping	\$500	\$500	\$500	\$500	\$500
16. Establish multiple use corridor / buffer zone	To be determined				
17. Assess hydrological data and develop a Salinity Management Strategy	\$500	\$500	\$500	\$500	\$500
Yearly total	\$32,500	\$18,500	\$21,500	\$18,500	\$21,500

Total cost: \$112,500

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Michael Davis	Shire of Serpentine-Jarrahdale
Stefan De Haan	CALM's Swan Coastal District
Andrew Del Marco	Formerly of Shire of Serpentine-Jarrahdale
Val English	CALM's WA Threatened Species and Communities Unit
Rebecca Evans	CALM's Swan Region
Bob Gilkes	University of Western Australia
Bronwen Keighery	Department of Environmental Protection
Greg Keighery	CALM's Science Division
Ted Love	Local farmer and enthusiast
Robyn Luu	CALM's WA Threatened Species and Communities Unit
David Mitchell	CALM's Swan Region
Sue Osborne	Shire of Serpentine-Jarrahdale
John Riley	CALM's Wildlife Branch
Tim Ryan	Serpentine-Jarrahdale Land Care Centre
Nancy Scade	Serpentine-Jarrahdale Land Care Centre
Monica Sparnon	Serpentine-Jarrahdale Land Care Centre
Jan Star	Shire of Serpentine-Jarrahdale

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There have been several Management Plans for Mundijong Road and Duckpond Reserve prepared since 1996. This document draws heavily on this previous work, as follows:

Keighery, B. (1996) *Flora Information for Roadside Bush Protection Plans in the Shire of Serpentine-Jarrahdale*. Report prepared for the Roadside Care Volunteers. Perth, Western Australia.

Neiman J. and Del Marco A. (1998) *Mundijong Road Flora Reserve Management Plan*. Internal Document, Shire of Serpentine-Jarrahdale.

Trudi Evans (2000) *Mundijong Road Flora reserve Management Plan Draft*. Internal Document; Shire of Serpentine-Jarrahdale.

Nancy Scade (2000) *Management to maintain and enhance vegetation and flora values*. Draft.

Blair Bloomfield (1998) *Duckpond Reserve Draft Management Plan*. Internal document; Shire of Serpentine-Jarrahdale.

REFERENCES

- Atkins, K.J. (2003) *Declared Rare and Priority Flora List for Western Australia*. Department of Conservation and Land Management, Perth.
- Brown, K. and Brooks, K. (2003) *Bushland Weeds; a practical guide to their management*. Environmental Weeds Action Network, Perth.
- Buchanan, Robin A. (1989) *Bush Regeneration – Recovering Australian Landscapes* TAFE. NSW, Australia.
- Churchward, H.M. and McArthur, W.M. (1980) Landforms and Soils of the Darling System. In: *Atlas of Natural Resources, Darling System, Western Australia*. Perth, Pinjarra and Collie Sheets. Department of Conservation and Environment, Perth.
- Coy, N.J (1979) *The Serpentine. A history of the Shire of Serpentine-Jarrahdale*. Shire of Serpentine-Jarrahdale. Mundijong, Western Australia.
- Davidson, W.A. (1995) Hydrogeology and Groundwater Resources of the Perth Region, Western Australia. *Geological Survey of Western Australia Bulletin* 142.
- Del Marco, A (1999) Correspondence from Shire of Serpentine-Jarrahdale to Executive Director, Department of Conservation and Land Management (reference: E70101:ADM:se).
- Department of Conservation and Land Management (1990a) *Data on the Conservation of Vegetation Associations on the Swan Coastal Plain*. Unpublished Report. Perth, Western Australia.
- Department of Conservation and Land Management (1990b) *Speakers Kit: Fight Dieback: Give our plants a chance*. Department of Conservation and Land Management Perth, Western Australia.
- Department of Environmental Protection (1994) GIS. *Threatened or Poorly Reserved Plant Communities Requiring Interim Protection*. Environmental Protection Authority. Perth, Western Australia.
- Department of Environmental Protection (1996) *System 6 update program unpublished site and area records and analysis*. Environmental Protection Authority. Perth, Western Australia.
- Del Marco, A. and Moore, K. (June 2000) *Shire of Serpentine-Jarrahdale Parkcare Plan. A plan to guide management of Council's bushland, waterway and other low maintenance reserves (Draft)* Shire of Serpentine-Jarrahdale internal publication.
- English, V. and Blyth, J. (1997) *Identifying and Conserving Threatened Ecological Communities in the South West Botanical Province*. Project N702, Final Report to Environment Australia. Department of Conservation and Land Management, Perth.
- English, V. and Blyth, J. (2000a) *Eucalyptus calophylla – Kingia australis* woodlands on heavy soil (Swan Coastal Plain Community type 3a – Gibson *et al.* 1994) Interim Recovery Plan 59. Department of Conservation and Land Management, Perth.
- English, V. and Blyth, J. (2000b) *Eucalyptus calophylla – Xanthorrhoea preissii* woodlands on heavy soil (Swan Coastal Plain Community type 3c – Gibson *et al.* 1994) Interim Recovery Plan 60. Department of Conservation and Land Management, Perth.
- Environmental Protection Authority (1999) Metropolitan Region Scheme Amendment No. 991/33 South West Districts Omnibus (No. 3b). Report and Recommendations of the Environmental Protection Authority. *Environmental Protection Authority Bulletin* 952.
- Environmental Protection Authority (2002) Tonkin Highway Extension from Mills Road West Gosnells to South Western Highway Mundijong. Main Roads Western Australia. Report and Recommendations of the Environmental Protection Authority. *Environmental Protection Authority Bulletin* 1043.
- Evans, R., Willers, N. and Mitchell, D. (Draft) Threatened flora of Swan Region - Wildlife Management Program Guidelines. Unpublished report to Environment Australia from the Department of Conservation and Land Management.
- Fall, V.G. (1972) *The Mills of Jarrahdale*. V.G. Hall. Perth, Western Australia.
- Gibson, N., Keighery, B., Keighery, G., Burbidge, A and Lyons, M. (1994) *A floristic survey of the Southern Swan Coastal Plain*. Unpublished report for the Australian Heritage Commission prepared by the Department of Conservation and Land Management and the Conservation Council of Western Australia.
- Government of Western Australia (2000) *Bush Forever*. Volume 2. Department of Environmental Protection, Western Australia.

- Hammond, J.E. (1933) *Winjan's People. The Story of the south-west Australian Aborigines*. Imperial Printing Company Ltd.
- Helyar, K. (1994) *Dieback Interpreters Procedural Manual*. Department of Conservation and Land Management, Perth.
- Hopkins, A.J.M., Brown, J.M. and Goodsell, J.T. (1987) A Monitoring System for Use in the Management of Natural Areas in Western Australia. Pp 337-339 in *Nature Conservation: the Role of Remnants of Native Vegetation* ed. by D.A. Saunders, G.W. Arnold, A.A. Burbidge, and A.J.M. Hopkins. Surrey Beatty and Sons, Sydney.
- Keighery, B. (1996) *Flora Information for Roadside Bush Protection Plans in the Shire of Serpentine-Jarrahdale*. Report prepared for the Roadside Care Volunteers, Perth.
- Keighery, B.J., Keighery, G.J., and Gibson, N. (1997) *Floristics of Reserves and Bushland areas of the Perth Region (System 6) Parts XI - XV*. Wildflower Society of Western Australia, Nedlands.
- Keighery, B. and Trudgen, M. (1992) *Remnant Vegetation on the Alluvial Soils of the Eastern Side of the Swan Coastal Plain*. Unpublished report for Department of Conservation and Land Management, Australian Heritage Commission and Heritage Council of WA.
- Panetta, F.D and Hopkins, A.J.M. (1991) Weeds in Corridors: Invasion and Management. Pp 341-351 in *Nature Conservation 2 the Role of Corridors* ed by D.A. Saunders, and R.J Hobbs. Surrey Beatty & Sons Pty Limited. Chipping Norton, NSW.
- Richards, R. (1978) *The Murray District of Western Australia. A History*. Shire of Murray.
- Shire of Serpentine-Jarrahdale (2002a) *Multiple use trails within the Shire of Serpentine-Jarrahdale (DRAFT)*, Shire Policy LPP9.
- Shire of Serpentine-Jarrahdale (2002b) *Parkcare Plan. A plan to guide management of Council's bushland, waterway and other low maintenance reserves*. Shire of Serpentine-Jarrahdale, Western Australia.
- Tuffnell, G. and Brown, E. (1999) Dieback mapping at Mundijong Road Reserve for the Shire of Serpentine-Jarrahdale. Glevan Dieback Consultancy Services.
- Western Australian Planning Commission (1998) *Metropolitan Region Scheme Amendment No. 991/33. South West Districts Omnibus (No. 3b). City of Cockburn, Fremantle, Melville, and Rockingham, the Town of Kwinana and the Shire of Serpentine-Jarrahdale. Amendment Report*. Western Australian Planning Commission, Perth.
- Western Australian Planning Commission (2000) *Metropolitan Region Scheme Amendment No. 991/33. South West Districts Omnibus (No. 3b). City of Cockburn, Fremantle, Melville, and Rockingham, the Town of Kwinana and the Shire of Serpentine-Jarrahdale. Volume 1 Report on Submissions*. Western Australian Planning Commission, Perth.

Appendix 1

Mundijong Road flora and weed list [Source: Keighery, B.J., Keighery, G.J., and Gibson, N. (1997) *Floristics of Reserves and Bushland areas of the Perth Region (System 6) Parts XI - XV*. Wildflower Society of Western Australia, Nedlands.]

All taxa (species, subspecies and varieties) observed along the study roads are listed. The study road on which the taxa are found is indicated as well as various features of the flora (see below). These features were selected as they highlight the conservation values of the flora.

Key

Column 1: Family, Conservation Status and Regional distributions

Conservation Status

Conservation and Land Management Declared Rare Flora and Priority Taxa (Atkins 1996)

- R** = Declared Rare Flora
- 1** = Priority 1: Poorly Known Taxa
- 2** = Priority 2: Poorly Known Taxa
- 3** = Priority 3: Poorly Known Taxa
- 4** = Priority 4: Rare Taxa

Regional distributions

Regional ecological preferences

- e** = taxa endemic to the eastern side of the Swan Coastal Plain*
- H** = taxa characteristic of sandy clay soils on the eastern side of the Swan Coastal Plain*
- s** = taxa characteristic of sandy soils on the eastern side of the Swan Coastal Plain*
- I** = taxa confined to inundated areas (sumplands/claypans)
- P** = non-local planted taxa
- * southern side south of Busselton

Geographical Location (range ends)

- N** = population at the northern limit of their known geographic range
- S** = population at the southern limit of their known geographic range
- D** = populations disjunct from their known geographic range

Column 2: Taxon

Names follow Gibson *et al.* (1994) unless indicated otherwise. Taxa yet to be named have an attached reference collection number from the relevant collector. A * preceding the name indicates a weed. An "ms" after the name indicates that this is a manuscript name which is yet to be published.

Columns 3 - 8: Plant Communities

Mundijong Road

- MU** = Marri Woodland
- MW** = Wetland Mosaic
- (C)** = confined to *Casuarina obesa* area

Mundijong/Duckpond Road Intersection

- DU** = Marri Woodland
- DW** = Wetland Mosaic (not mapped)

- D** = disturbed area

	MU	MW	DU	DW
Amaranthaceae				
H <i>Ptilotus drummondii</i>			•	
H <i>Ptilotus manglesii</i>		•		•
Anthericaceae				
H <i>Agrostocrinum scabrum</i>	•		•	
H <i>Borya scirpoidea</i>		•		•
H <i>Borya sphaerocephala</i>		•		•
<i>Caesia micrantha</i>	•		•	
H <i>Caesia micrantha</i> "blue" (GJK 10857)		•		
<i>Chamaescilla corymbosa</i>	•	•		
<i>Dichopogon capillipes</i>			•	
H <i>Dichopogon preissii</i>				•
<i>Laxmannia ramosa</i>		•		
<i>Laxmannia squarrosa</i>	•			
<i>Sowerbaea laxiflora</i>	•		•	
<i>Thysanotus dichotomus</i>	•			
<i>Thysanotus manglesianus</i>	•		•	
<i>Thysanotus multiflorus</i>		•		
<i>Thysanotus patersonii</i>	•			
<i>Thysanotus sparteus</i>	•			
<i>Thysanotus thyrsoideus</i>		•		•
<i>Thysanotus triandrus</i>			•	
<i>Tricoryne elatior</i>	•		•	
<i>Tricoryne humilis</i>	•		•	
Apiaceae				
eH <i>Eryngium pinnatifidum</i> subsp. <i>palustre</i> ms				•
<i>Hydrocotyle alata</i>				•
<i>Hydrocotyle callicarpa</i>		•		•
<i>Hydrocotyle diantha</i>		•		
H <i>Schoenolaena juncea</i>		•		•
<i>Xanthosia huegelii</i>			•	
Aponogetonaceae				
e4H <i>Aponogeton hexatepalus</i>				•
Asparagaceae				
* <i>Asparagus asparagoides</i>	•		•	
Araceae				
* <i>Zantedeschia aethiopica</i>				•
Asteraceae				
H <i>Angianthus drummondii</i>		•		•
H <i>Brachyscome bellidioides</i>		•		•
<i>Brachyscome iberidifolia</i>		•		
* <i>Conyza bonariensis</i>	•	•	•	•
<i>Cotula cotuloides</i>		•		
* <i>Dittrichia graveolens</i>	•	•	•	•
<i>Hyalosperma cotula</i>	•		•	
* <i>Hypochaeris glabra</i>	•	•	•	•
<i>Olearia elaeophila</i>			•	•
eH <i>Podolepis gracilis</i> (Swamp form GJK 13126)		•		•
eH <i>Pogonolepis stricta</i> "long bract form" (GJK 13226)				•

Siloxerus humifusus	•	•	•	•
* Sonchus oleraceus	•	•	•	•
H Trichocline spathulata			•	
* Ursinia anthemoides	•	•	•	•
Casuarinaceae				
Allocauarina humilis	•			
D Allocauarina microstachya		•		
Casuarina obesa		•		
Centrolepidaceae				
Aphelia cyperoides		•		•
H Brizula drummondii				•
H Brizula nutans		•		
Centrolepis aristata		•(C)		•
Centrolepis humillima		•		
Centrolepis inconspicua		•		
H Centrolepis mutica		•		
Colchicaceae				
Burchardia umbellata	•		•	
Burchardia multiflora		•		•
Crassulaceae				
Crassula closiana		•		
Cuscutaceae				
* Cuscuta epithymum		•		
Cyperaceae				
H Chorizandra enodis		•(C)		
H Cyathochaeta avenacea		•		
* Cyperus tenellus		•		•
* Isolepis hystrix	•			
Isolepis oldfieldiana		•		•
Lepidosperma squamatum	•		•	
Lepidosperma sp eastern terete (BJ & NG 232)		•		
Lepidosperma leptostachyum	•			
Lepidosperma longitudinale		•		
E Mesomelaena tetragona	•	•	•	•
H Schoenus bifidus		•		
Schoenus brevisetis		•		
Schoenus humilis		•		
Schoenus nanus		•		
Schoenus odontocarpus		•		•
Schoenus rigens		•		
Schoenus sp. 2 (GJK 5739)				
Schoenus breviculmis		•		
Schoenus subflavus	•			
Schoenus tenellus		•		•
Schoenus unispiculatus		•		
Tetragonia capillaris		•		•
Tetragonia octandra	•		•	
Tricostularia neesii var. neesii		•	•	
Dasypogonaceae				
HNCalectasia grandiflora		•		
Kingia australis	•	•		

Lomandra caespitosa	•	•		
Lomandra micrantha		•		
Lomandra sonderi				•
Lomandra suaveolens	•		•	
Dilleniaceae				
Hibbertia acerosa	•		•	
Hibbertia commutata	•		•	
Hibbertia hypericoides	•			
Droseraceae				
Drosera erythrorhiza			•	
Drosera gigantea		•		•
Drosera heterophylla		•		
eH Drosera macrantha (Swan Coastal Plain form BJK&NG 228)	•		•	
Drosera menziesii subsp. penicillaris	•			
Drosera menziesii subsp. menziesii		•		
H Drosera rosulata		•		•
H Drosera tubaestylis				•
Epacridaceae				
Astroloma ciliatum	•		•	
Astroloma pallidum			•	
Leucopogon squarrosus		•		
Euphorbiaceae				
Phyllanthus calycinus	•		•	
Gentianaceae				
* Cicendia filiformis		•		•
Geraniaceae				
Geranium retrorsum			•	
Goodeniaceae				
4H Anthotium junciforme		•		•
Dampiera alata				
Dampiera linearis			•	
Goodenia caerulea			•	
Goodenia micrantha				•
Lechenaultia biloba			•	
Lechenaultia expansa				•
H Scaevola lanceolata				•
Scaevola phlebopetala			•	
Scaevola pilosa		•(C)		
Haemodoraceae				
H Anigozanthos viridis		•		•
Conostylis aculeata			•	
Haemodorum brevisepalum	•			
Haemodorum laxum			•	
Haemodorum sparsiflorum	•		•	
H Haemodorum simplex	•			•
Haemodorum spicatum	•		•	
Tribonanthes australis		•		•
H Tribonanthes brachypetala		•		
H Tribonanthes violacea		•		
Haloragaceae				

H	<i>Myriophyllum drummondii</i>		•		
e3H	<i>Myriophyllum echinatum</i>				•
Hydatellaceae					
H	<i>Trithuria bibracteata</i>		•		•
Hypericaceae					
Hn	<i>Hypericum japonicum</i>				•
Hypoxidaceae					
H	<i>Hypoxis occidentalis</i>		•		•
Iridaceae					
*	<i>Babiana angustifolia</i>		•		
*	<i>Gladiolus angustus</i>		•		
*	<i>Gladiolus caryophyllaceus</i>	•			
*	<i>Moraea flaccida</i>	•			
	<i>Patersonia occidentalis</i>	•	•	•	
	<i>Patersonia occidentalis</i> (swamp form NG&ML 544)		•(C)		
*	<i>Romulea rosea</i>		•		•
*	<i>Sparaxis bulbifera</i>		•		
*	<i>Watsonia marginata</i>	•	•		
*	<i>Watsonia meriana</i> var. <i>bulbillifera</i>	•	•	•	•
Isoetaceae					
H	<i>Isoetes drummondii</i>				
Juncaceae					
	<i>Juncus bufonius</i>		•		
*	<i>Juncus capitatus</i>		•		
	<i>Juncus pauciflora</i>				•
	<i>Luzula meridionalis</i>				•
Juncaginaceae					
	<i>Triglochin procerum</i>				•
Lauraceae					
	<i>Cassytha flava</i>				
	<i>Cassytha glabella</i>				•
Lentibulariaceae					
H	<i>Utricularia multifida</i>		•		•
H	<i>Utricularia tenella</i>		•		
Lobeliaceae					
	<i>Lobelia tenuior</i>			•	
*	<i>Monopsis debilis</i>		•		•
Loganiaceae					
	<i>Phyllangium paradoxum</i> (= <i>Mitrasacme paradoxa</i> in Gibson <i>et al.</i> 1994, Dunlop 1996)	•	•	•	•
Loranthaceae					
	<i>Nuytsia floribunda</i>		•		
Mimosaceae					
	<i>Acacia incurva</i>				•
eH	<i>Acacia lasiocarpa</i> var. <i>bracteolata</i>				
	<i>Acacia saligna</i>		•		•
	<i>Acacia stenoptera</i>	•		•	
Myrtaceae					
	<i>Astartea fascicularis</i>		•		•
	<i>Baeckea camphorosmae</i>			•	

3HS	Baeckea tenuifolia		•		
H	Calothamnus hirsutus		•		
H	Calytrix aurea		•		
	Eucalyptus calophylla	•	•	•	•
	Eucalyptus rudis		•		•
	Hypocalymma angustifolium	•	•	•	•
	Kunzea ericifolium		•		•
	Kunzea micrantha				•
	Kunzea recurva				•
H	Melaleuca lateriflora subsp. acutifolia		•		
	Melaleuca lateritia		•		•
H	Melaleuca pauciflora		•		
	Melaleuca preissiana				•
	Melaleuca raphiophylla		•		•
H	Melaleuca uncinata		•		
H	Melaleuca viminea				•
	Pericalymma ellipticum	•	•		
	Regelia ciliata		•		
H	Verticordia acerosa		•		
	Verticordia densiflora		•		
H	Verticordia huegelii var. huegelii		•		
H	Verticordia pennigera		•		
eRH	Verticordia plumosa var. pleiobotrya		•		
	Orchidaceae				
H	Caladenia paludosa ms	•		•	
H	Diuris carinata		•		
H	Diuris emarginata		•		
	Elythranthera emarginata	•			
	Microtis media				•
*	Disa bracteata	•	•	•	•
H	Thelymitra antennifera		•		•
	Thelymitra crinita	•		•	
	Oxalidaceae				
*	Oxalis glabra		•		
*	Oxalis pes-caprae	•		•	
	Papilionaceae				
	Daviesia angulata			•	
	Daviesia physodes			•	
	Eutaxia virgata				•
	Gompholobium marginatum			•	
	Gompholobium tomentosum			•	
	Jacksonia furcellata			•	
e	Jacksonia sericea (= J. aff. sericea swamp form, Gibson <i>et al.</i> 1994)	•	•		
	Jacksonia sternbergiana			•	
	Kennedia stirlingii			•	
*	Lotus angustissimus	•	•	•	•
*	Lotus subbiflorus				
	Mirbelia spinosa				
*	Trifolium angustifolium			•	
*	Trifolium campestre			•	

* Trifolium subterraneum			•	
Viminaria juncea		•		•
Philydraceae				
H Philydrella drummondii		•		
H Philydrella pygmaea				•
Phormiaceae				
Dianella revoluta var. divaricata			•	
H Stypandra glauca			•	
Poaceae				
Lachnagrostis preissii				•
* Aira caryophyllea				
Amphibromus neesii		•(C)		
Amphipogon debilis				
Amphipogon turbinatus				
* Avena barbata			•	
* Briza maxima	•	•	•	•
* Briza minor			•	•
* Cynodon dactylon				
Notodanthonia caespitosa				
Notodanthonia pilosa				
Dichelachne crinita		•		•
* Ehrharta calycina	•		•	
* Ehrharta longiflora	•		•	
Eragrostis elongata				•
* Eragrostis curvula		•		•
* Hordeum leporinum	D			
* Lolium perenne		•		
* Lolium rigidum				
H Neurachne alopecuroidea			•	•
* Paspalum dilatatum				•
* Pennisetum clandestinum				•
* Pentaschistis airoides	•	•	•	•
Poa ?poiformis			•	
Austrostipa campylachne	•		•	
Austrostipa elegantissima			•	
Austrostipa pycnostachya	•		•	
Themeda triandra			•	
* Vulpia bromoides			•	
* Vulpia myuros			•	
Primulaceae				
* Anagallis arvensis			•	•
Proteaceae				
H Banksia telmatiaea		•		
Dryandra lindleyana (D. nivea Gibson <i>et al.</i> 1994)		•		
H Grevillea bipinnatifida	•			
H Grevillea pilulifera			•	
Hakea ceratophylla		•		
Hakea incrassata		•		
Hakea lissocarpha			•	
H Hakea marginata		•		
Hakea prostrata			•	

Hakea trifurcata		•		
Hakea varia		•(C)		•
H Petrophile media var. juncifolius ms		•		
Petrophile seminuda		•		
Petrophile squamata		•		
Synaphea floribunda (= S."stenoloba" fine leaves (BJK&NG 244) Gibson <i>et al.</i> 1994)		•		
Synaphea petiolaris	•	•	•	•
Restionaceae				
H Harperia lateriflora		•		
Hypolaena exsulca	•	•	•	•
Lepidobolus preissianus	•			
H Meeboldina crebriculmis		•		
Chaetanthus aristatus		•		
Meeboldina cana		•		
Meeboldina coangustata		•		
Lepyrodia macra		•(C)		•
Lepyrodia muiirii		•(C)		•
Desmocladius fasciculatus	•	•	•	•
Desmocladius flexuosus			•	
Rubiaceae				
D Opercularia apiciflora			•	
Opercularia vaginata			•	
Rutaceae				
Philothea spicata	•	•		
Sellaginellaceae				
Selaginella gracillima				•
Scrophulariaceae				
* Bartsia trixago				
Gratiola pubescens				•
* Parentucellia viscosa				•
Stackhousiaceae				
Stackhousia monogyna				
Tripterococcus brunonis				
Stylidiaceae				
Levenhookia pusilla				•
Stylidium calcaratum	•	•	•	•
H Stylidium canaliculatum				•
Stylidium dichotomum		•		•
Stylidium divaricatum				•
H Stylidium inundatum		•		•
H Stylidium leptophyllum				•
3H Stylidium longitubum				•
eH Stylidium mimeticum				•
Stylidium petiolare		•		•
Stylidium pulchellum				•
H Stylidium roseo-alatum				•
H Stylidium utricularioides		•		•
Thymelaeaceae				
H Pimelea imbricata var. major				•

Xanthorrhoeaceae				
Xanthorrhoea preissii	•		•	
Xanthorrhoea brunonis				•
Zamiaceae				
Macrozamia riedlei			•	

Appendix 2

Definitions of Declared Rare and Priority Flora [Source: Atkins, K.J. (2003) *Declared Rare and Priority Flora List for Western Australia*. Department of Conservation and Land Management, Perth.]

CONSERVATION CODES

R: Declared Rare Flora - Extant Taxa

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.

X: Declared Rare Flora - Presumed Extinct Taxa

Taxa which have not been collected, or otherwise verified, over the past 50 years despite thorough searching, or of which all known wild populations have been destroyed more recently, and have been gazetted as such.

1: Priority One - Poorly known Taxa

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

2: Priority Two - Poorly Known Taxa

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

3: Priority Three - Poorly Known Taxa

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

4: Priority Four - Rare Taxa

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

Note, the need for further survey of poorly known taxa is prioritised into the three categories depending on the perceived urgency for determining the conservation status of those taxa, as indicated by the apparent degree of threat to the taxa based on the current information.

Appendix 3

Mundijong Road Weed distribution map [source: Keighery, B. (1996) *Flora Information for Roadside Bush Protection Plans in the Shire of Serpentine-Jarrahdale*. Report prepared for the Roadside Care Volunteers, Perth.]