DISTRICT COUNCIL OF
ORRORO/CARRIETON
Southern Flinders Ranges • Established 1997

Orroroo Carrieton

Roadside Vegetation Management Plan

District Council of Orroroo Carrieton

TABLE OF CONTENTS

June 2003 (updated February 2010 by Erica Rees Natural Resources and Sustainability Officer)

Prepared by Roger Playfair and Melissa Horgan
RMP Environmental Pty Ltd
P O Box 2, DAW PARK, S A, 5041
Partially funded under the Natural Heritage Trust

LIST OF FIGURES

LIST OF MAPS

EXECUTIVE SUMMARY

In response to a request from the District Council of Orroroo/Carrieton for comprehensive and detailed information and guidelines for the management of the native vegetation remnants on the roadsides under their control, surveys were undertaken in October 2002. A total of 703 km of roadsides were surveyed in the Orroroo/Carrieton Local Government area.

The data were recorded in the standard format for the South Australian Roadside Vegetation Database, administered by the Department of Transport, Energy and Infrastructure and the Department for Environment and Heritage. This information was recorded as descriptions of the dominant species, vegetation structure, understorey structure, condition (in terms of degree of alteration from original composition), dominant weeds present, type of disturbance and other relevant notes or comments.

Background information including the native vegetation in the region, its remnancy and conservation significance is included in this report. Management guidelines for the entire current Orroroo/Carrieton area are presented for all roadsides, and some specific recommendations made for certain areas of high conservation significance. This survey ranked roadside segments totalling 58.75 km (5.9% of 986.2km surveyed) as appropriate for special management due to their botanical composition and low levels of weed infestation.

Roadside segments recommended for special conservation management (Management Category A or B) have been identified on Murray Town Orroroo Road, Boundary Road, Crocker Hill Road, Bully Acre Road, Narien Road, Oladdie Road, Gorge Road, Black Rock Clare Road, Hawker Orroroo Road, Orroroo Ucolta Road, Eurelia West Road, McCallum Road, Pekina Black Rock Road, and Yalpara Road.

They cover a range of vegetation types:

Vegetation Type	**Length (km)**
Callitris preissii low Woodland	0.2
Allocasuarina verticillata low Woodland	0.2
Eucalyptus odorata low Woodland	0.6
Eucalyptus leucoxylon low Woodland	0.2
Eucalyptus camaldulensis Woodland	0.95
Eucalyptus socialis ± *E. gracilis* open Mallee	2.15
Eucalyptus gracilis ± *E. socialis* open Mallee	0.3
Eucalyptus porosa ± *E. odorata* open Mallee	7.4
Dodonaea viscosa ssp. *angustissima* Shrubland	0.1
Acacia victoriae Shrubland	0.6
Mixed *Acacia* spp. Shrubland	1.0
Senna artemisioides ssp. ± *Acacia* ssp. ± *Dodonaea viscosa* ssp. *angustissima* ± *Eremophila longifolia* Shrubland	4.9
Mixed chenopod low Shrubland	13.5
Plantation dominated by indigenous or non-indigenous native species	3.9
Grassland dominated by native species	24.15

1 INTRODUCTION

1.1 GENERAL BACKGROUND

In the past, Local Government Councils have had different cultures in regard to roadside vegetation management. There is now a move to adopting more uniform policies across regions. The policy of sustainable management of the environment includes developing and implementing native vegetation management plans within a wider regional framework, such as within catchment boundaries or bioregions.

During the past decade a considerable amount of work has been done in the Mount Lofty Ranges and elsewhere to document significant areas of native roadside vegetation. At the same time, there has been growing community recognition that careful management of these sites is needed. In response, Councils are now adopting a wider role in the areas of environmental monitoring, co-ordinating community groups such as Friends Groups, Landcare, Bushcare, and consultation through community centred advisory committees.

To ensure the benefits of roadside vegetation are maintained, careful management of activities that affect these sites are required. Even minor activities that affect small areas of native vegetation can have a collectively significant effect when continued over a period of time.

While it is understood that the primary function of road reserves is to provide a safe carriageway for the movement of vehicles, the District Council of Orroroo Carrieton (DCOC) identifies the need to balance this function with the protection of native vegetation along the roadsides. This Management Plan provides the policies, strategies and actions required to achieve this balance on the road reserves under the control of the DCOC.

Road reserves were originally intended to provide access to farm properties and allow for the movement of people and goods, however with changes in how we now view the use of public land, road reserves have had to become much more multi-purpose. Some of the different uses of roadsides (some of which are no longer considered appropriate) are:

FUNCTIONAL USES

Firewood collection and timber harvesting
Fire prevention and suppression
Installation and maintenance of services; gas, electricity, water, sewerage, and telecommunications
Road construction, road widening and maintenance
Stockpiles and dumpsites
Safety buffer zones for errant vehicles
Water supply catchments

CULTURAL AND RECREATIONAL USES

Historic, cultural or archaeological sites
Paths for pedestrians, motor cycles, bicycles or horses
Visual amenity and scenic landscapes for road users and tourists
Wayside stops and rest areas for motorists

AGRICULTURAL USES

Apiculture, cropping, haymaking & grazing
Droving and the movement of livestock
Windbreaks or shelterbelts
Ploughing, cultivating or grading

CONSERVATION USES

Protecting and conserving remnant indigenous vegetation
Providing habitats for native fauna and flora
Protection of rare, threatened or significant flora and fauna (e.g. a very small percentage of original grasslands remain in South Australia, and many of the extinct fauna species were once found in these grasslands. Roadsides contain many of these grassland remnants)
Important gene pools and seed/propagule sources
Regeneration areas for native plant communities
Wildlife corridors for fauna movement and links of genetic material

Accommodating all of these different uses and achieving consensus on roadside management presents an enormous challenge to local communities. Providing solutions to these conflicting pressures is a major

outcome of the roadside management plan process. The following objectives should all be satisfied by a good management plan:

Protect:
indigenous vegetation
rare or threatened flora or fauna
cultural or heritage assets
community assets from fire

Enhance:
indigenous vegetation communities
fauna habitats and corridors

Maintain:
safe function of the road
indigenous vegetation communities
fauna habitats and corridors
visual amenity and landscape qualities
water quality

Minimise:
land degradation
spread of weeds and vermin
spread of soil borne pathogens
risk and impact of fire
site specific conflicts
maintenance costs
disturbance during installation and maintenance of services

1.2 ROADSIDE SURVEYS IN SOUTH AUSTRALIA

1.2.1 HISTORY

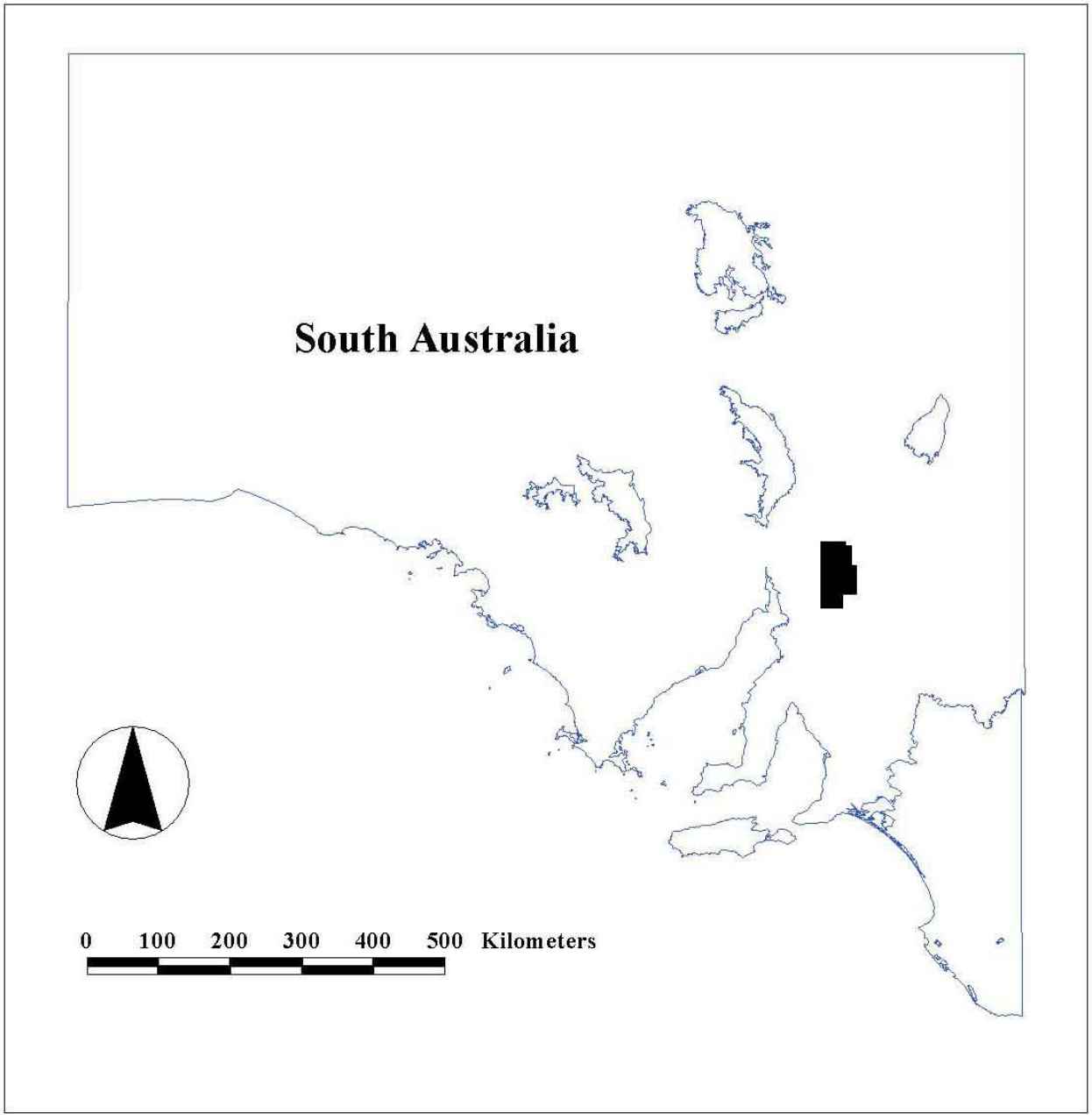
Many of South Australia's road reserves support native vegetation representing important remnants of pre-European vegetation. To minimise the impact on this important vegetation, road managers need comprehensive information on the conservation value of vegetation and the location of sites that are of particularly high biodiversity (significance) value. Vegetation inventory information, collected using a standard survey methodology, greatly enhances and supports roadside vegetation management planning (Stokes *et al.* 1999).

Since 1987, in South Australia, numerous roadside surveys have been conducted using a variety of survey techniques at a variety of scales and accuracies. (Palmer *et al.* 1987) covered Kangaroo Island, South East, Murray Mallee, Mount Lofty Ranges, Mid North, and Yorke and Eyre Peninsulas. (Wigan *et al.* 1989) added to some parts of this work and provided some management guidelines for Yorke Peninsula as well. (Donato 1991) covered the Lameroo, Pinnaroo, Karoonda-East Murray, Browns Well and Peake District Council areas. (Pedler *et al.* 1993) included quite comprehensive vegetation information in their study of the Mallala District Council area. (Crawford 1994) looked at the Stirling District Council area and (Hyde *et al.* 1996) led the movement into GIS-compatible mapping of roadsides for the Murray Bridge and Mannum District Councils. Goolwa-Port Elliot, Victor Harbor and Yankalilla were surveyed in 1997 (Hyde 1997). The Strathalbyn District has been assessed (Hyde 1998). Mount Pleasant District Council was surveyed in 1998 (Playfair 1998) and Transport SA began a comprehensive survey of all roadsides under their jurisdiction in November 1998. The Barossa Council Survey (Playfair 2000) built on the previous work undertaken in the Mount Pleasant Council (Playfair 1998). Mount Remarkable District Council completed a survey and management plan for their area in 2000 (Playfair 2000) and Telfer (2001) systematically surveyed the Northern Areas Council. With some assistance from Natural Heritage Trust and Native Vegetation Council funding, other Local Governments have undertaken such surveys and produced management plans since then, and some are currently in progress.

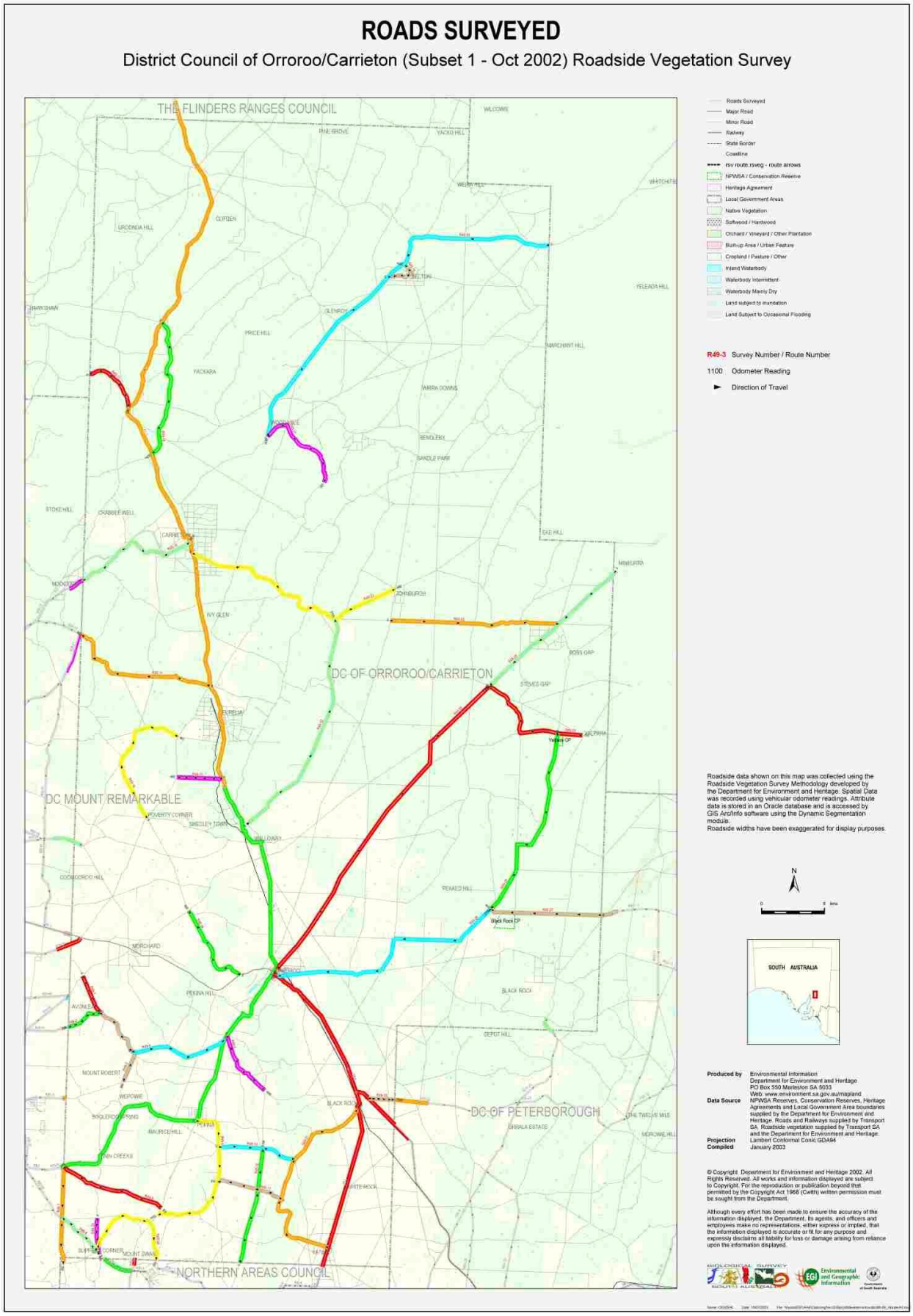
Though there is this apparently huge amount of information available, there are compatibility problems arising from the range of survey techniques used, which makes comparisons between regions difficult. These problems highlighted the need to develop a more standardized approach to roadside vegetation surveys.

1.2.2 SURVEY AREA

This survey covers 703 km of roadsides maintained by the Orroroo/Carrieton District Council (Map 2) and describes segments of roadside verge. Previous survey and assessment work done by Department of Transport, Energy and Infrastructure (DTEI) on roads under their control in the Mid North region amounting to further 283.2 km has been included in the total surveyed and assessed in this study.



Map 1 Orroroo/Carrieton District Council - Location



Map 2 Orroroo/Carrieton District Council - Roads Surveyed

1.2.3 SURVEY METHODS

The method used for data collection and analysis for this roadside survey is the standard method for South Australian roadside vegetation surveys described by Stokes *et al.* (1999).

This method enables the rapid, systematic collection of data describing remnant indigenous vegetation in road reserves. The vegetation characteristics that were recorded have been tailored to maximise the management-related value of the data, enabling an assessment of the ecological value and conservation significance of the vegetation. A more comprehensive description of the type of data gathered and the method of collection is in the Guide to the Roadside Vegetation Survey Methodology for South Australia produced by DTEI (Stokes *et al.* 1999).

A roadside vegetation survey consists of a rapid assessment that briefly describes all the vegetation present on selected roadsides. It maps the distribution of remnant native vegetation and collects data used to determine the level of weed infestation, ecological significance and management requirements of different remnants. This component is a "drive-by" survey, as most data are collected while in a vehicle driving along roads.

Another component of the methodology involves using the data collected during the drive-by assessment to identify sites suitable for other projects. For example, sites containing high quality vegetation with few weeds may be identified as potential sites for management under the Trees for Life, Bushcare program, or wide, unvegetated road reserves linking patches of remnant vegetation may be identified as potential revegetation sites.

1.3 COUNCIL ROADSIDE VEGETATION POLICY

The overarching roadside vegetation policy of the District Council of Orroroo Carrieton is:

To protect and conserve the native vegetation on roadsides under the control of the DCOC, whilst providing a safe and functional road network.

1.3.1 KEY OBJECTIVES

This management plan is intended to serve the following purposes

- to meet legal requirements for the provision and maintenance of a safe road network
- to meet legal requirements for the protection of native roadside vegetation
- to achieve an appropriate balance between roadside vegetation conservation and safe access for vehicles and machinery
- to maintain and enhance the native vegetation occurring on roadsides, especially the habitat and corridor value for indigenous flora and fauna
- to minimise the adverse impacts of activities occurring within the roadside vegetation corridor
- to establish and maintain an assessment process of minor clearance proposals to ensure compliance with the Plan and the Native Vegetation Council
- to define DCOC policies and guidelines in relation to roadside vegetation management
- to improve the awareness of the community, Council employees and contractors, and other authorities of roadside vegetation values and management issues

2 LANDFORMS AND NATIVE VEGETATION IN THE REGION

2.1 ENVIRONMENTAL ASSOCIATIONS

Native vegetation types have evolved so that they occur in an environment that enables their survival. Areas of differing geology, soil type or rainfall often support different mixtures of plants, both native and non-native. In an effort to understand better the variation in land types, a team of researchers from CSIRO (Laut *et al.* 1977) described in general terms, the whole of South Australia. The State was divided into "Environmental Provinces", large areas of gross geomorphologic similarities, "Environmental Regions", areas within Provinces of similar climatic, geological and land use, and "Environmental Associations" (EA), areas within Regions with a similar range of landforms, soils, geomorphologic, and climatic factors.

These "Environmental Associations" as described by Laut *et al.* (1977) provide a regional overview of the range of vegetation types and their associated land types in the Orroroo/Carrieton District (Map 3).

The following basic descriptions relate to the areas shown on Map 3.

Appila EA
Undulating plain on shale.

Cereal crops, grassland, chenopod shrubland and parkland with native grass understorey.

Bundara EA
Undulating colluvial plains with isolated low hills and low quartzite ridges.

Open woodland and scrubland with chenopod shrubland understorey.

Buckalowie EA
Intramontane basin with fans and floodplains.

Low open woodland, low chenopod shrubland and fringing woodland with an understorey of grasses and ephemeral forbs.

Cradock EA
Intramontane plain comprising fans, footslopes and floodplain.

Tall shrubland with understorey of grasses, woodland fringing the channel.

Koonamore EA
Undulating to hilly plain on metasediments and granite, and occasional quartzite ridges

Low chenopod shrublands and low open woodland.

Moochra EA
Strike ridges and intramontane plains comprising footslopes and fans.

Low open woodland and tall shrubland with grass understorey, sedgeland, low chenopod shrubland and some cropland.

Tarcowie EA
Plain with narrow quartzite strike ridges.

Cereal cropland, grassland, open woodland with native grass understorey.

Terowie EA
Dissected quartzite and siltstone ridges, separated by narrow pediments and colluvial plains.

Grasslands, tall shrublands and open scrubland.

Walloway EA
Coalescing fans merging with alluvial plains.

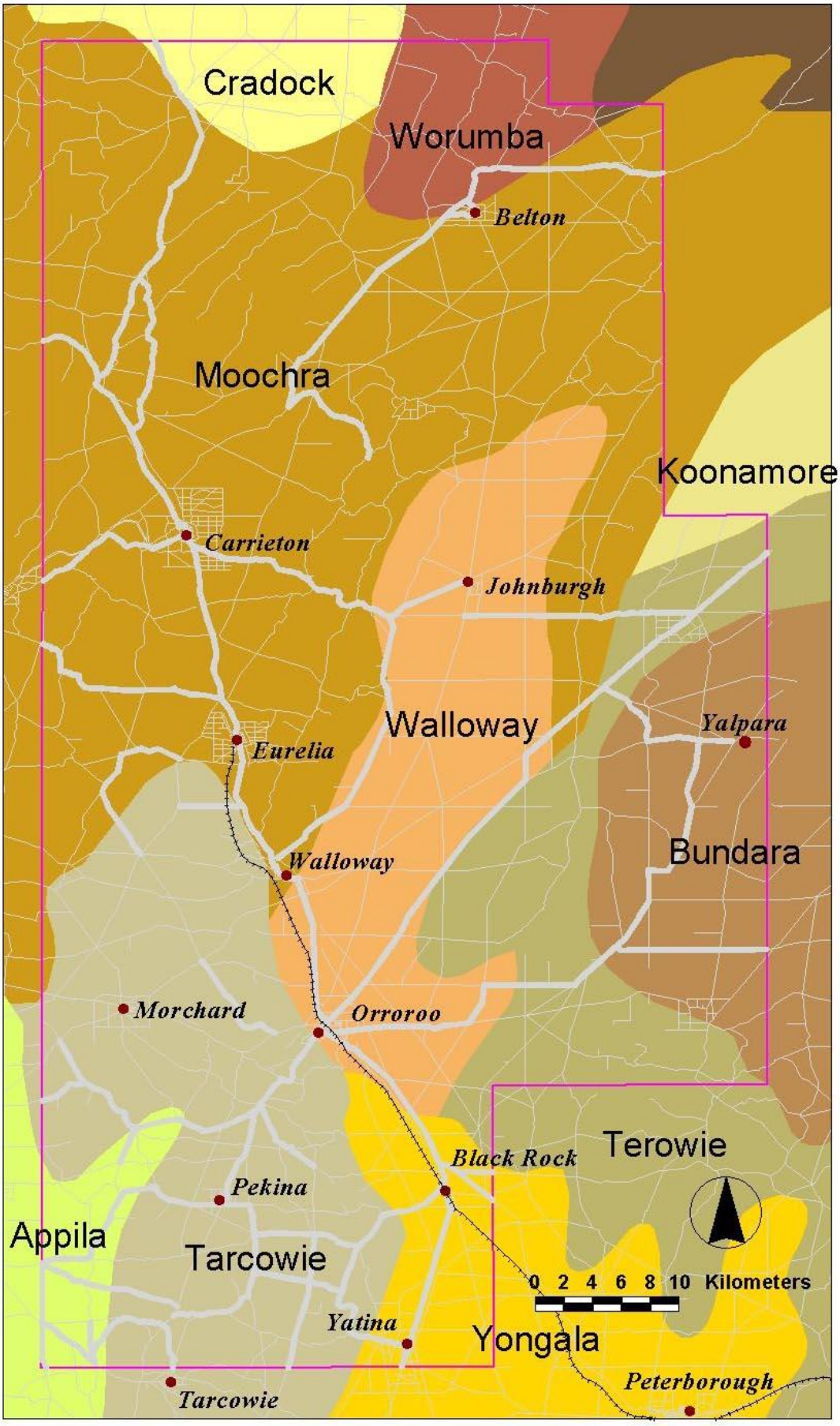
Sedgeland, low shrubland, low open woodland and cereal cropland.

Worumba EA
High steep quartzite ridges and lower rounded shale ridges and hills.

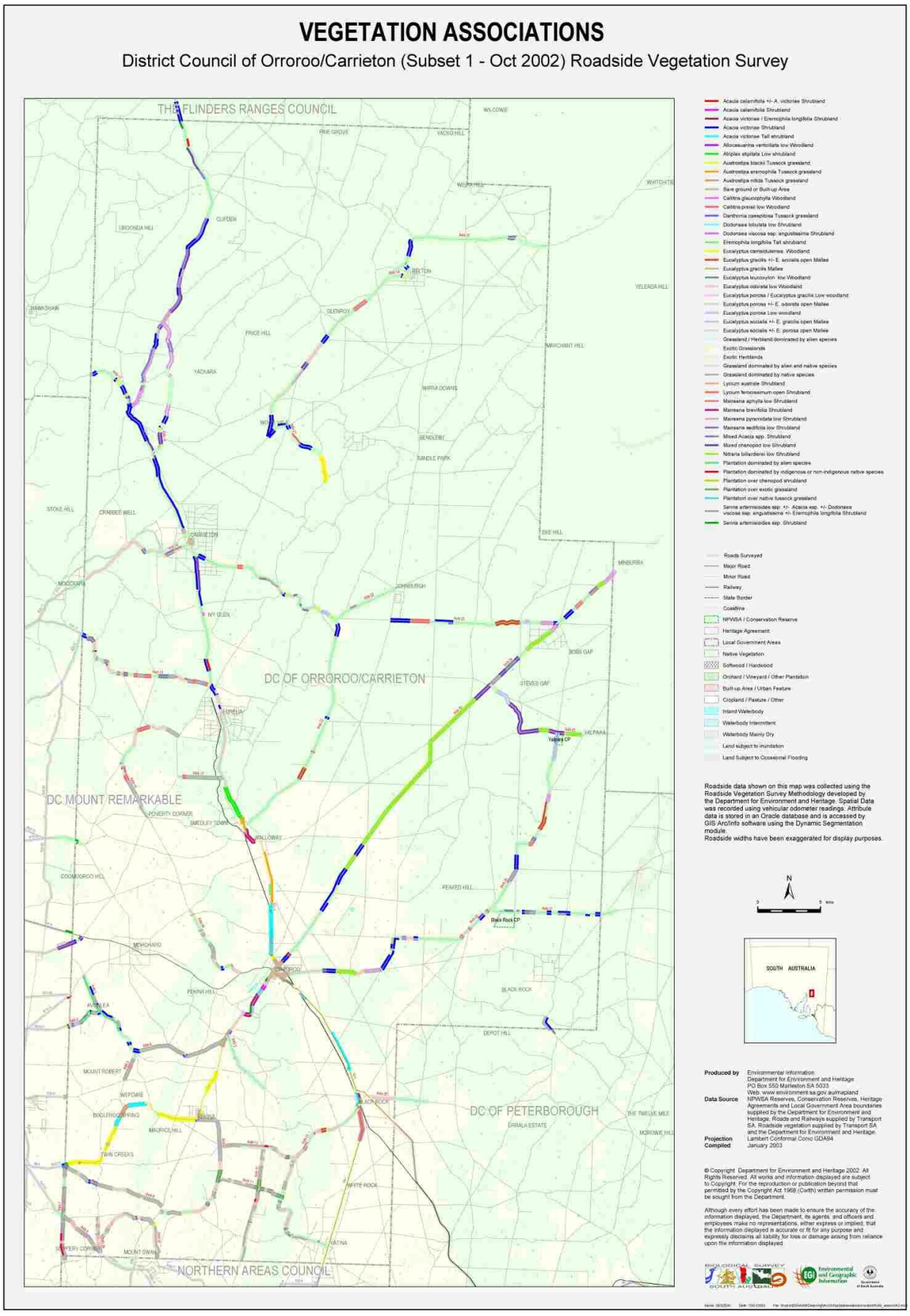
Low open woodland and tall shrubland over grasses, ephemeral forbs and saltbush.

Yongala EA
Intramontane plain.

Cereal crops, pastures, chenopod shrubland, grassland and parkland with understorey of native grasses.



Map 3 Orroroo/Carrieton District Council – Environmental Associations (Laut *et al.* 1977). Surveyed roads are shown in light grey.



Map 4 Orroroo/Carrieton District Council – Vegetation Associations

2.2 GENERAL DESCRIPTION OF REMNANT NATIVE VEGETATION

The following descriptions have been derived from botanical literature relating to the study area, or have been developed specifically for the purpose of labelling certain groups of plants in this District for management purposes. The outcomes of this survey and analysis must be management oriented, and consequently the groupings chosen here to cover the variety and range of mixtures of plants are not necessarily ecological groupings. There has been an attempt to make these classifications logical and related to environmental factors for the ease of application to revegetation projects. Past and current management has altered the original botanical composition in much of the District, and some of these groupings described below have resulted from these changes. Any classification system is largely artificial and simply for convenience, and drawing sharp boundaries between them has no ecological meaning. In the Orroroo/Carrieton District, soil, aspect and rainfall gradients are quite significant, and have a major effect on the botanical composition of the vegetation.

The conservation ratings assigned were derived from Neagle (1995) and from this author's understanding of the diversity, quality and extent of remnants of these vegetation types **in the study area**. They are not necessarily applicable to other regions. Table 1 lists these vegetation types and gives descriptions for the ratings. Their distribution in the Orroroo/Carrieton District is shown on Map 4 "Orroroo/Carrieton District Council - Vegetation Associations" (including DTEI roads).

Table 1 Vegetation Associations and their Regional Conservation Significance rating.

Description	Cons	Source
WOODLAND		
Callitris preissii low Woodland (1)	2	Malcolm & Sherrah 2000 (2701), Robertson 1998
Casuarina pauper Woodland (2)	3	Specht 1972, Malcolm & Sherrah 2000 (3303), Forward & Robinson 1996
Eucalyptus odorata low Woodland (23)	1	Neagle 1995, Specht 1972 Malcolm & Sherrah 2000 (601) Robertson 1998
Eucalyptus camaldulensis Woodland (26)	3	This study, Malcolm & Sherrah 2000 (2102)
Allocasuarina verticillata low Woodland (27)	3	Robertson 1998, Malcolm & Sherrah 2000 (1503)
Eucalyptus leucoxylon low Woodland (28)	3	This study, Malcolm & Sherrah 2000 (902)
MALLEE		
Eucalyptus socialis ± E. gracilis open Mallee (3)	3	Specht 1972, Malcolm & Sherrah 2000 (2402), Forward & Robinson 1996
Eucalyptus socialis ± E. porosa open Mallee (4)	3	Specht 1972, Malcolm & Sherrah 2000 (2408), Forward & Robinson 1996
Eucalyptus gracilis ± E. socialis open Mallee (5)	3	Specht 1972, Malcolm & Sherrah 2000 (2501), Forward & Robinson 1996
Eucalyptus porosa ± E. odorata open Mallee (6)	2	Malcolm & Sherrah 2000 (306), Robertson 1998, Neagle 1995
SHRUBLAND		
Dodonaea viscosa ssp. angustissima Shrubland (7)	3	Forward & Robinson 1996
Dodonaea lobulata low Shrubland (8)	3	This study Forward & Robinson 1996
Acacia victoriae Shrubland (9)	3	This study
Mixed Acacia spp. Shrubland (10)	3	This study
Senna artemisioides ssp. ± Acacia ssp. ± Dodonaea viscosa ssp. angustissima ± Eremophila longifolia Shrubland (11)	3	This study Malcolm & Sherrah 2000 (5901)
Muehlenbeckia florulenta Shrubland (12)	3	Malcolm & Sherrah 2000 (4501)
Mixed chenopod low Shrubland (13)	3	This study, Malcolm & Sherrah 2000 (4701)
Maireana pyramidata low Shrubland (14)	3	Specht 1972, Malcolm & Sherrah 2000 (3601), Forward & Robinson 1996
Maireana sedifolia low Shrubland (15)	2	Specht 1972, Malcolm & Sherrah 2000 (2901), Forward & Robinson 1996
Maireana aphylla low Shrubland (16)	3	Malcolm & Sherrah 2000 (801)
Nitraria billardierei low Shrubland (24)	3	This study, Malcolm & Sherrah 2000 (3101)
Lycium ferocissimum open Shrubland (25)	5	This study
PLANTATION		
Plantation dominated by indigenous or non-indigenous native species (17)	4	This study
Plantation dominated by alien species (18)	5	This study

Description	Cons	Source
GRASSLAND / HERBLAND		
Grassland / Herbland dominated by alien species (19)	5	This study
Grassland dominated by alien and native species (20)	2	Neagle 1995, Specht 1972, Forward & Robinson 1996
Grassland dominated by native species (21)	1	Neagle 1995 Specht 1972 Malcolm & Sherrah 2000 (101, 201, 2301, 4901) Forward & Robinson 1996
Bare ground or Built-up Area (22)	5	This study

Notes

Numbers in brackets in the Source column refer to 1;50,000 map units assigned by Malcolm & Sherrah (2000) for Mid North floristic mapping

Numbers in brackets in the Description column refer to Vegetation Association Numbers assigned by this study and correlate to those in the raw data

Conservation Ratings

1. Very high conservation rating; includes any associations whose Conservation Status was identified by Neagle (1995) as Poor or Nil; typically includes associations that are extensively cleared and/or most degraded.
2. High conservation rating; may include associations whose Conservation Status was identified by Neagle (1995) as Moderate or Reasonable; typically includes associations that are moderately cleared.
3. Moderate conservation rating; includes relatively common associations whose Conservation Status was identified by Neagle (1995) as either Reasonable or Excellent; may also include some mixed native vegetation that cannot be categorized readily into a formal association type
4. Low conservation rating; may include some mixed native ± exotic vegetation that cannot be categorized readily into a formal association type.
5. Of no conservational significance; very little or no vegetation.

Every segment of the roads surveyed has been assigned to one of the vegetation types described. Regional distribution of some of these vegetation types and the soils and topography of their locations are described in the "Environments of South Australia" (eg. Walloway EA (Laut *et al.* 1977)).

The total length of roadside (in km) assigned to Overall Significance rankings A to E are summarised in the next section for each vegetation type. The derivation of Overall Significance is described in Section 3.1.3.

Description	Length (km)
WOODLAND	
Callitris preissii low Woodland (1)	**10.35**
Eucalyptus odorata low Woodland (23)	**9.5**
Eucalyptus camaldulensis Woodland (26)	**7.45**
Allocasuarina verticillata low Woodland (27)	**0.5**
Eucalyptus leucoxylon low Woodland (28)	**8.4**
MALLEE	
Eucalyptus socialis ± *E. gracilis* open Mallee (3)	**10.75**
Eucalyptus socialis ± *E. porosa* open Mallee (4)	**0.3**
Eucalyptus gracilis ± *E. socialis* open Mallee (5)	**10.55**
Eucalyptus porosa ± *E. odorata* open Mallee (6)	**10.5**
SHRUBLAND	
Dodonaea viscosa ssp. *angustissima* Shrubland (7)	**1.35**
Dodonaea lobulata low Shrubland (8)	**0.2**
Acacia victoriae Shrubland (9)	**103.8**
Mixed *Acacia* spp. Shrubland (10)	**19.8**
Senna artemisioides ssp. ± *Acacia* ssp. ± *Dodonaea viscosa* ssp. *angustissima* ± *Eremophila longifolia* Shrubland (11)	**24.8**
Mixed chenopod low Shrubland (13)	**43.65**
Maireana pyramidata low Shrubland (14)	**29.1**
Maireana sedifolia low Shrubland (15)	**16.15**
Maireana aphylla low Shrubland (16)	**12.3**
Nitraria billardierei low Shrubland (24)	**45.85**
Lycium ferocissimum open Shrubland (25)	**3.0**

Description	Length (km)
PLANTATION	
Plantation dominated by indigenous or non-indigenous native species (17)	**2.8**
Plantation dominated by alien species (18)	**8.25**
GRASSLAND / HERBLAND	
Grassland / Herbland dominated by alien species (19)	**356.45**
Grassland dominated by alien and native species (20)	**79.95**
Grassland dominated by native species (21)	**142.5**
Bare ground or Built-up Area (22)	**5.1**

CALLITRIS PREISSII LOW WOODLAND (1) (conservation significance rating 2)

Overall Significance	A	B	C	D	E	Total
Length (km)	-	-	4.9	5.45	-	10.35

Mainly found in hilly areas of quartzite and siltstone in the Oladdie Hills (southern part of Moockra AE) and north of Peterborough in the Barra Hill and Depot Hill area (Terowie EA) is dominated in the overstorey by *Callitris preissii* (southern cypress pine), occasionally with some *Eucalyptus odorata* (peppermint box). Middle level shrubs often include *Acacia victoriae* (elegant wattle), *Acacia calamifolia* (wallowa), *Senna artemisioides* ssp. (punty bush) and sometimes *Dodonaea viscosa* ssp. *angustissima* (narrow-leaved hopbush). The ground layer has *Lomandra multiflora* ssp. *dura* (iron grass), *L. effusa* (scented iron grass), *Austrostipa* spp. (spear grasses), *Danthonia* spp. (wallaby grasses), *Vittadinia gracilis* (woolly New Holland daisy), *Dianella revoluta* (black anther flax lily), *Chloris truncata* (windmill grass) and exotic grasses and herbs.

Plate 1 *Callitris preissii* woodland over herbs and grasses on Belforest Road, 10 km south of Carrieton (54H 268827 6398614)

EUCALYPTUS ODORATA LOW WOODLAND (23) (conservation significance rating 1)

Overall Significance	A	B	C	D	E	Total
Length (km)	-	0.6	8.9	-	-	9.5

Mainly found in the hills of the northern Mount Lofty Ranges and the adjacent plains, and not extending much north of Wilmington. In the study area, it occurs only around Pekina (Appila EA) (Laut *et al.* 1977). The upper stratum of this vegetation type is dominated by *Eucalyptus odorata* (peppermint box), occasionally with sparse *E. leucoxylon* (blue gum). Middle shrub layer can contain *Senna artemisioides* ssp. (punty bushes), *Acacia hakeoides* (hakea wattle), *Bursaria spinosa* (sweet bursaria) and *Alectryon oleifolius* ssp. *canescens* (bullock bush). Chenopod shrubs *Enchylaena tomentosa* (ruby saltbush) and *Rhagodia parabolica* (mealy saltbush) are often found in the low shrub layer. *Austrostipa* spp. (spear grass) is common and *Lomandra* spp. (iron grass) also often occurs in the ground layer. This group occurs on flat or undulating plains with red duplex soils, and also on ridges with red duplex soils and mottled-yellow duplex soils overlying slate.

Plate 2 *Eucalyptus odorata* open woodland over *Rhagodia parabolica* and litter on Black Rock Pekina Road approx. 5 km southwest of Black Rock (54H 278779 6360821).

EUCALYPTUS CAMALDULENSIS WOODLAND (26) (conservation significance rating 3)

Overall Significance	A	B	C	D	E	Total
Length (km)	-	-	0.6	6.85	-	7.45

Eucalyptus camaldulensis (red gum) is widespread throughout the Orroroo/Carrieton District in valley floors and floodplains of low slope on variable soil types, usually associated with drainage lines (Tarcowie and Moockra EA) (Laut *et al.* 1977), both as a dominant overstorey species as well as an emergent in other vegetation types. This woodland is mostly monospecific *E. camaldulensis* at tree level, while grasses, ephemeral forbs, reeds and pasture species are most likely to dominate the ground level. Other native species that may be associated with the red gum in the study area include *Acacia victoriae* (elegant wattle), usually on adjacent creek terraces, or *Callitris preissii* (southern cypress pine). The native grass *Cymbopogon ambiguus* (lemon scented grass) is commonly found along with ephemeral exotic herbs such as *Sisymbrium* spp. (mustard/rocket) and *Brassica tournefortii* (wild turnip) in the sandy or stony creek lines.

Plate 3 *Eucalyptus camaldulensis* woodland over exotic herbs and grasses in a creek line on Carrieton to Johnburgh Road near Oladdie, approx. 11 km from Carrieton (54H 278159 6405010). Note *Triodia scariosa* ssp. (porcupine grass) on adjacent footslope.

ALLOCASUARINA VERTICILLATA LOW WOODLAND (27) (conservation significance rating 3)

Overall Significance	A	B	C	D	E	Total
Length (km)	-	0.1	0.2	0.2	-	0.5

Woodlands dominated by *Allocasuarina verticillata* (drooping sheoak) can be found on a large range of soil types throughout the southern Flinders and northern Mount Lofty Ranges. The northern extremity of the distribution of this vegetation type extends into the Pekina to Tarcowie area (south-western corner) of the Orroroo/Carrieton District on variable soil types on slopes and low hills (Appila and Tarcowie EA) (Laut *et al.* 1977). The upper stratum is dominated by *Allocasuarina verticillata* (drooping sheoak) with a tall shrub layer often containing *Bursaria spinosa* (sweet bursaria), *Acacia pycnantha* (golden wattle) and sometimes *Eremophila longifolia* (long-leaved emu bush). The ground layer usually has *Triodia scariosa* ssp. (porcupine grass), *Xanthorrhoea quadrangulata* (yacca), *Themeda triandra* (kangaroo grass), *Lomandra multiflora* ssp. *dura* (iron grass) and *Austrostipa* spp. (spear grass).

Plate 4 *Allocasuarina verticillata* low woodland over *Lomandra* spp. and *Triodia scariosa* ssp. on Tarcowie Road near Mount Raphael approximately 5 km north of Tarcowie (54H 266854 6357106).

EUCALYPTUS LEUCOXYLON LOW WOODLAND (28) (conservation significance rating 3)

Overall Significance	A	B	C	D	E	Total
Length (km)	-	-	0.5	7.9	-	8.4

This grouping describes areas dominated by *E. leucoxylon* ssp. *leucoxylon* (South Australian blue gum) and in some places *E. leucoxylon* ssp. *pruinosa* (blue gum) and *Allocasuarina verticillata* (drooping sheoak). Understorey is variable and often contains *Rhagodia parabolica* (mealy saltbush) and sometimes *Bursaria spinosa* (sweet bursaria). The ground layer usually has *Triodia scariosa* ssp. (porcupine grass), *Themeda triandra* (kangaroo grass), *Austrostipa* spp. (spear grasses), *Lomandra multiflora* ssp. *dura* (iron grass) and *Vittadinia gracilis* (woolly New Holland daisy). This vegetation type is found on slopes in low hills with red duplex soils overlying alluvium and shale of the Narien Range between Yatina and Pekina (Tarcowie EA) (Laut *et al.* 1977).

Plate 5 *Eucalyptus leucoxylon* low Woodland over *Austrostipa* spp., *Danthonia* spp., *Lomandra multiflora* ssp. *dura*, *Triodia scariosa* and exotic grasses and herbs on Narien Road approx. 10 km west of Yatina (54H 276653 6358267).

EUCALYPTUS SOCIALIS ± E. GRACILIS OPEN MALLEE (3) (conservation significance rating 3)

Overall Significance	A	B	C	D	E	Total
Length (km)	-	1.2	3.85	5.7	-	10.75

This variable vegetation type is dominated by *E. socialis* (red mallee) often with codominant *Eucalyptus gracilis* (yorrell). The shrub understorey is variable depending on soil type, and can include *Rhagodia parabolica* (mealy saltbush), *Olearia muelleri* (Mueller's daisy bush), *Senna artemisioides* ssp. (punty bushes), *Acacia hakeoides* (hakea wattle), *Westringia rigida* (stiff westringia), and chenopod shrubs. This mallee vegetation type occurs on quartzite and siltstone ridges and low hills, plains and shallow, stony soils (Terowie and Bundara EA) and alluvial fans (Walloway EA) (Laut *et al.* 1977). Litter cover is prominent at ground level, and the chenopod shrubs, *Maireana* spp. (bluebushes) and *Atriplex* spp. (saltbushes) and *Austrostipa* spp. (spear grasses) are often very sparse.

Plate 6 *Eucalyptus socialis* open mallee over *Atriplex vesicaria*, litter and bare ground (condition 3) on Yalpara Road approx. 6 km northeast of Yalpara (54H 293574 6398875).

EUCALYPTUS SOCIALIS ± E. POROSA OPEN MALLEE (4) (conservation significance rating 3)

Overall Significance	A	B	C	D	E	Total
Length (km)	-	-	-	0.3	-	0.3

On roadsides, mainly noted in the low hills around Parnaroo to Oodla Wirra in the Peterborough District Council area (Terowie EA) (Laut *et al.* 1977), this vegetation type is dominated by *E. socialis* (red mallee) with some *E. porosa* (mallee box). The shrub understorey often includes *Rhagodia parabolica* (mealy saltbush), *Senna artemisioides* ssp. (punty bushes), *Maireana brevifolia* (small-leaved bluebush), *Dissocarpus paradoxus* (cannonballs) and native grasses with leaf litter. Native grasses are more common under the canopy and exotics become more dominant in the open areas outside the canopy shade/low soil moisture area.

High levels of litter cover and bare ground are common at ground level, and chenopod shrubs, *Maireana* spp. (bluebushes) and *Atriplex* spp. (saltbushes) and *Austrostipa* spp. (spear grass) are often very sparse.

Plate 7 *Eucalyptus socialis* ± *E. porosa* open mallee on plains with very shallow stony soil over litter and bare ground with some shrubs, *Acacia calamifolia*, *A. hakeoides*, *Senna artemisioides* and *Atriplex vesicaria* on Erskine Road, approx. 11 km north of Peterborough (54H 293681 6359680).

EUCALYPTUS GRACILIS ± E. SOCIALIS OPEN MALLEE (5) (conservation significance rating 3)

Overall Significance	A	B	C	D	E	Total
Length (km)	-	0.3	-	10.25	-	10.55

Similar to the *Eucalyptus socialis* ± *E. gracilis* open mallee described above, except that the overstorey is dominated by *Eucalyptus gracilis* (yorrell), sometimes with *E. socialis* (red mallee) over sparse mixed understorey of *Senna artemisioides* ssp. (punty bush), *Eremophila scoparia* (broom emu-bush), *Olearia muelleri* (Mueller's daisy bush), sparse chenopod shrubs and grasses. Litter is very prominent in the often very sparse understorey. This mallee vegetation type occurs on quartzite and siltstone ridges and low hills, plains and shallow, stony soils (Terowie and Bundara EA) and alluvial fans (Walloway EA) (Laut *et al.* 1977).

Mallee vegetation is extremely good at scavenging available soil water, and due to the shallow and free-draining soils, in a semi-arid environment, litter cover is prominent at ground level. The chenopod shrubs, *Maireana* spp. (bluebushes) and *Atriplex* spp. (saltbushes) and *Austrostipa* spp. (spear grasses) are often very sparse.

Plate 8 *Eucalyptus gracilis* ± *E. socialis* open mallee on low stony, loamy soils over litter and bare ground on Butterfields Road, approx. 5 km east of Butterfields (54H 292508 6404425).

EUCALYPTUS POROSA ± E. ODORATA OPEN MALLEE (6) (conservation significance rating 2)

Overall Significance	A	B	C	D	E	Total
Length (km)	-	7.2	1.9	1.4	-	10.5

More common further east on roadsides in the low hills around Parnaroo to Oodla Wirra, this vegetation type is dominated in the overstorey by *Eucalyptus porosa* (mallee box), sometimes with *E. odorata* (peppermint box), *E. socialis* (red mallee), *E. gracilis* (yorrell) and *Callitris preissii* (southern cypress pine). The shrub layer is very varied and diverse, often containing *Senna artemisioides* ssp. (punty bush), *Dodonaea viscosa* ssp. *angustissima* (narrow-leaved hop bush), *Acacia wattsiana* (Watt's wattle), *A. calamifolia* (wallowa), *A. nyssophylla*, *A. hakeoides* (hakea wattle), *Melaleuca lanceolata* (dryland teatree), *Exocarpos aphyllus* (leafless cherry) and *Rhagodia parabolica* (mealy saltbush). *Austrostipa* spp. (spear grass), *Lomandra effusa* (scented iron grass), *Dianella revoluta* (black anther flax lily), *Themeda triandra* (kangaroo grass) and *Triodia scariosa* ssp. (porcupine grass) are often found in the ground layer.

Plate 9 *Eucalyptus porosa* open mallee on low hills over *Triodia scariosa*, *Acacia hakeoides* and *A. wattsiana* on Gorge Road in the Narien Range approx. 4 km west of Yatina (54H 278650 6356317).

DODONAEA VISCOSA SSP. ANGUSTISSIMA SHRUBLAND (7) (conservation significance rating 3)

Overall Significance	A	B	C	D	E	Total
Length (km)	-	-	0.1	1.25	-	1.35

This vegetation type is limited in extent, and found on roadsides mainly east of Orroroo and north of Peterborough on low hills with calcareous loamy soils (Terowie EA) (Laut *et al.* 1977). It is dominated by *Dodonaea viscosa* ssp. *angustissima* (narrow-leaved hop bush), often with *Senna artemisioides* ssp. (punty bushes) *Acacia victoriae* (elegant wattle), *A. calamifolia* (wallowa), *A. nyssophylla*, *A. hakeoides* (hakea wattle) and sometimes with *Callitris preissii* (southern cypress pine) or *Eucalyptus porosa* (mallee box) emergent over chenopod shrubs and grasses and herbs. *Austrostipa* spp. (spear grass), *Lomandra effusa* (scented iron grass), *Dianella revoluta* (black anther flax lily) and *Chloris truncata* (windmill grass) are often also found in the ground layer.

Plate 10 *Dodonaea viscosa* ssp. *angustissima* with *Senna artemisioides* ssp. on red sandy soil over exotic grasses and herbs on Peterborough Ucolta Road approx. 3 km west of Ucolta (54H 307597 6352170).

DODONAEA LOBULATA LOW SHRUBLAND (8) (conservation significance rating 3)

Overall Significance	A	B	C	D	E	Total
Length (km)	-	-	-	0.2	-	0.2

This group, found on rocky hillslopes is dominated by *Dodonaea lobulata* (lobed hop bush) with some *Senna artemisioides* ssp. *coriacea* (broad leaf desert senna), *Senna artemisioides* ssp. *petiolaris* (flat-stalk senna), *Alectryon oleifolius* ssp. *canescens* (bullock bush) at low shrub level and *Sclerolaena diacantha* (grey bindyi) and very sparse exotic herbs and grasses on the ground. It occurs much more commonly further northeast in the Olary Ranges, predominantly on rocky rises and low hills with shallow loamy soils. *Sida petrophila* (rock sida) and *Zygophyllum aurantiacum* (shrubby twin-leaf) are also commonly associated with *D. lobulata*.

Plate 11 *Dodonaea lobulata* shrubland on shallow calcareous soil over shale on Oladdie Road 5 km east of Carrieton (54H 266891 6398746).

ACACIA VICTORIAE SHRUBLAND (9) (conservation significance rating 3)

Overall Significance	A	B	C	D	E	Total
Length (km)	-	-	0.6	103.2	-	103.8

This group is the most common native vegetation type in the study area with *Acacia victoriae* (elegant wattle) dominating the overstorey. *A. victoriae* is often monospecific at shrub level over chenopods *Maireana brevifolia* (short-leaved bluebush) *M. pyramidata* (black bluebush), *Rhagodia spinescens* (spiny saltbush), *Senna artemisioides* (punty bushes) and numerous exotic and native grasses and herbs. The majority of this vegetation type in the study area is of condition 4 or 5, due to high levels of exotic invasion. The short-lived (10-15 years), fast-growing characteristics (Turnbull 1986) of *Acacia victoriae* may indicate widespread regeneration in previously degraded areas. This vegetation type occurs mainly on plains, floodplains and fans and is often associated with drainage lines and creek terraces (Terowie, Moockra, Bundara and Walloway EA) (Laut *et al.* 1977).

Plate 12 Very sparse *Acacia victoriae* shrubland over exotic herbs and grasses on Black Rock Dawson Road approx. 1 km east of Black Rock (54H 284063 6366238).

MIXED ACACIA SPP. SHRUBLAND (10) (conservation significance rating 3)

Overall Significance	A	B	C	D	E	Total
Length (km)	-	-	1.9	17.9	-	19.8

Some areas were dominated by vegetation that did not seem to have a clear or consistent dominant species; rather it was a variable mixture of tall shrubs (mainly Acacias) over a low shrub and ground layer of chenopod shrubs, grasses and herbs. *Acacia victoriae* (elegant wattle), *A. calamifolia* (wallowa), *A. nyssophylla*, *A. hakeoides* (hakea wattle), *A. wilhelmiana* (dwarf nealie), *A. wattsiana* (Watt's wattle), *A. notabilis* (notable wattle) and *A. pycnantha* (golden wattle) are the most common. *Dodonaea viscosa* ssp. *angustissima* (narrow-leaved hop bush), *Hakea leucoptera* (needle bush), and *Templetonia egena* (desert broom-bush), *Senna artemisioides* ssp. (punty bush) and *Bursaria spinosa* (sweet bursaria) are also commonly found in the mixture as sub-dominants. More commonly found in the low hills and rises of the Terowie Environmental Association (Laut *et al.* 1977), sometimes with *Eucalyptus porosa* (mallee box), *Callitris preissii* (southern cypress pine) emergent, this vegetation type is quite widespread throughout the study area. In some places it may represent a successional vegetation mix of short-lived colonisers in areas where the overstorey has been removed or unable to regenerate.

Plate 13 Sparse *Acacia* spp. shrubland comprising *A. hakeoides*, *A. calamifolia*, *A. wattsiana* and *Senna artemisioides* on stony calcareous soil over exotic herbs litter and bare ground on Black Rock Dawson Road near Barra Hill approx. 17 km east of Black Rock (54H 300244 6366645).

SENNA ARTEMISIOIDES SSP. ± ACACIA SSP. ± DODONAEA VISCOSA SSP. ANGUSTISSIMA ± EREMOPHILA LONGIFOLIA SHRUBLAND (11) (conservation significance rating 3)

Overall Significance	A	B	C	D	E	Total
Length (km)	-	1.3	3.2	20.3	-	24.8

This group is quite widespread and diverse, occurring mainly in low hills and rises south of Orroroo (Appila EA), and north and east of Peterborough (Moockra and Terowie EA) (Laut *et al.* 1977). It may actually be a part of a range of other taller shrublands, with the middle shrub layer, dominated by *Senna artemisioides* ssp. (punty bushes), being the most abundant. Consequently, it often consists of a wide variety of other sub-dominant shrubs, some of which are taller, and may be deemed emergent. *Acacia victoriae* (elegant wattle), *A. calamifolia* (wallowa), *A. nyssophylla*, *A. hakeoides* (hakea wattle), *Dodonaea viscosa* ssp. *angustissima* (narrow-leaved hop bush), *Hakea leucoptera* (needle bush), and *Templetonia egena* (desert broom-bush) are among these. Emergent *Eucalyptus* spp. (mallee), *Callitris preissii* (southern cypress pine) and *Myoporum platycarpum* (false sandalwood) are also common. Chenopod shrubs usually dominate the low shrub layer, with native grasses, exotic herbs and grasses in the ground layer.

There are sometimes quite dense groves of *Eremophila longifolia* (long-leaved emubush). It usually occurs in small, low-lying patches where the run-on surface water promotes the germination of denser stands of *Acacia victoriae*, and *E. longifolia*. Occasionally *Senna artemisioides* (punty bush), *Maireana pyramidata* (black bluebush), and *Maireana aphylla* (cotton bush) occur in the mid shrub layer.

Plate 14 Sparse *Senna artemisioides* spp. shrubland on a low rise over exotic herbs and grasses on Boundary Road approx. 8 km east of Booleroo Centre (54H 260478 6357587).

MIXED CHENOPOD LOW SHRUBLAND (13) (conservation significance rating 3)

Overall Significance	A	B	C	D	E	Total
Length (km)	-	6.8	8.9	27.95	-	43.65

This group commonly contains variable mixtures of *Maireana brevifolia* (short-leaved bluebush) *M. pyramidata* (black bluebush), *M. sedifolia* (pearl bluebush), *M. turbinata* (top fruit bluebush), *Rhagodia spinescens* (spiny saltbush), *Atriplex stipitata* (bitter saltbush), *A. vesicaria* (bladder saltbush) and in less well-drained areas *M. aphylla* (cotton bush). The ground flora is also hugely variable, though usually containing significant populations of exotic grasses and herbs. Minor variants are dominated by *Dissocarpus paradoxus* (cannonballs) with *Sida intricata* (twiggy sida). In the more heavily degraded areas, *Sclerolaena* spp. (bindyi) with *Atriplex stipitata* (bitter salt bush) and *Maireana pyramidata* dominate.

Plate 15 Mixed chenopod low Shrubland dominated by *Atriplex vesicaria* on sandy rise on Yalpara Road approx. 3 km northwest of Yalpara Conservation Park (54H 294322 6397892).

MAIREANA PYRAMIDATA LOW SHRUBLAND (14) (conservation significance rating 3)

Overall Significance	A	B	C	D	E	Total
Length (km)	-	-	-	29.1	-	29.1

Maireana pyramidata (black bluebush) dominates this group, sometimes almost completely, though often in association with other *Maireana* spp. (bluebushes), *Rhagodia spinescens* (spiny saltbush), Scaevola spinescens (spiny fan-flower), *Atriplex stipitata* (bitter saltbush), and *A. vesicaria* (bladder saltbush) over a mixture of exotic herbs and grasses. It is possible that the *M. pyramidata* has become dominant through sustained historical preferential grazing pressure decreasing the densities of more palatable species. This group occurs on floodplains with loams overlying alluvium (Moockra EA) (Laut *et al.* 1977), and undulating plains and low rises.

Plate 16 Sparse *Maireana pyramidata* low Shrubland with a ground layer dominated by *Carrichtera annua* with patches of *Avena barbata* on Butterfield Road approx. 10 km east of Johnburgh (54H 296637 6404869).

MAIREANA SEDIFOLIA LOW SHRUBLAND (15) (conservation significance rating 2)

Overall Significance	A	B	C	D	E	Total
Length (km)	-	-	6.2	9.95	-	16.15

This group dominated by *Maireana sedifolia* (pearl bluebush) is often almost monospecific in the shrub layer. In some areas *M. pyramidata* (black bluebush), *M. brevifolia* (small-leaved bluebush) and *Senna artemisioides* ssp. (punty bush) can be significant. It may sometimes occur with groves or emergent *Eucalyptus gracilis* (yorrell) and *Acacia victoriae* (elegant wattle) or *Casuarina pauper* (blackoak). The main ground layer consists of ephemeral forbs, *Atriplex* spp. (annual saltbushes) and *Sclerolaena* spp. (bindyi). Most common north of Peterborough, this low chenopod shrubland is usually found on plains and low hills and low rises with calcareous loams overlying gravel (Bundara EA) (Laut *et al.* 1977).

Plate 17 *Maireana sedifolia* low Shrubland with a ground layer dominated by *Carrichtera annua* on loamy soil on Minburra Road approx. 10 km southwest of Minburra(54H 295353 6402829).

MAIREANA APHYLLA LOW SHRUBLAND (16) (conservation significance rating 3)

Overall Significance	A	B	C	D	E	Total
Length (km)	-	-	5.8	6.5	-	12.3

This vegetation type is dominated by *Maireana aphylla* (cotton bush) and *Zygophyllum aurantiacum* (shrubby twin-leaf), usually quite sparse, over *Sclerolaena* spp. (bindyi), exotic and native grasses. Commonly, *Maireana pyramidata* (black bluebush) and *Atriplex* spp. (annual saltbush) are also present. This association often occurs with emergents such as *Acacia victoriae* (elegant wattle) and *Eremophila longifolia* (long-leaved emu bush). Widespread throughout the region (though minor in all Environmental Associations), populations are more common on roadsides around Belton, Yongala and Parnaroo.

Plate 18 *Maireana aphylla* low Shrubland with a ground layer dominated by exotic herbs and grasses on low-lying land on Parnaroo Terowie Road approx. 10 km south of Lancelot (54H 310295 6337764).

NITRARIA BILLARDIEREI LOW SHRUBLAND (24) (conservation significance rating 3)

Overall Significance	A	B	C	D	E	Total
Length (km)	-	-	3.2	42.65	-	45.85

In many areas (eg. plains between Orroroo and Minburra), *Nitraria billardierei* (nitre bush) has colonised land that has been laid bare in the past or cleared and cultivated for cropping. This creates a landscape consisting mainly of exotic species and strong colonisers such as *Critesion murinum* ssp. (barley grass), *Asphodelus fistulosus* (onion weed), *Carrichtera annua* (Ward's weed) and *Avena barbata* (wild oats). Less palatable species such as *Maireana pyramidata* (black bluebush) and *Sclerolaena* spp. (bindyi) are common. Generally, this vegetation type has low botanical diversity, and occurs on floodplains and drainage areas (Moockra and Walloway EA) (Laut *et al.* 1977).

Plate 19 Sparse *Nitraria billardierei* low Shrubland over *Carrichtera annua* and other exotic herbs and grasses on Minburra Road approx. 4 km southwest of Minburra (54H 299006 6406435).

LYCIUM FEROCISSIMUM OPEN SHRUBLAND (25) (conservation significance rating 5)

Overall Significance	A	B	C	D	E	Total
Length (km)	-	-	-	-	3.0	3.0

The almost total removal through long-term heavy grazing and clearing for cultivation has created an exotic open shrubland, dominated by a proclaimed noxious weed. This vegetation type occurring around Butterfield, near Johnburgh is almost a monoculture of mature *Lycium ferocissimum* (African boxthorn) shrubs with *Medicago* spp. (burr medic), *Asphodelus fistulosus* (onion weed) and *Carrichtera annua* (Ward's weed) covering the ground. *L. ferocissimum*, spread by birds and foxes is very common throughout the region and occurs in numerous other vegetation types as an exotic invader, but rarely attains the dominance to become the prominent species in the botanical composition.

Plate 20 *Lycium ferocissimum* open Shrubland over *Carrichtera annua* and *Medicago* sp. on Butterfield Road (54H 286817 6404442).

PLANTATION DOMINATED BY INDIGENOUS OR NON-INDIGENOUS NATIVE SPECIES (17) (conservation significance rating 4)

Overall Significance	A	B	C	D	E	Total
Length (km)	-	-	-	-	2.8	2.8

Many different indigenous or non-indigenous native species of trees and shrubs have been hand-planted throughout the region on roadsides. Some plantations comprise species grown from seed collected locally and others contain plants obtained from nurseries. Most are *Eucalyptus* spp., *Melaleuca* spp., *Callistemon* spp., *Casuarina* spp., *Acacia* spp. and other small shrubs. Some of these such as *Acacia saligna* (golden wreath wattle), apart from being interstate varieties, have the potential to become "environmental weeds".

Plate 21 *Eucalyptus* spp. *Casuarina* spp., *Acacia* spp plantation on Orroroo Jamestown Road approx. 10 km southeast of Orroroo (54H 281332 6370932).

PLANTATION DOMINATED BY ALIEN SPECIES (18) (conservation significance rating 4)

Overall Significance	A	B	C	D	E	Total
Length (km)	-	-	-	0.4	7.85	8.25

Many exotic species have been planted on roadsides for a variety of reasons this may include aesthetic value to crop and orchard plantations. The most common species occurring in the study area are Pines (*Pinus radiata* and *P. halepensis*) and Olives (*Olea europaea*), however may include Oaks, Ashes, Elms, Oleanders, Almonds, Apricots, Aloes and Tree lucerne.

Plate 22 Aleppo pine plantation on McCallum Road approx. 5 km south of Morchard (54H 261583 6371416).

GRASSLAND / HERBLAND DOMINATED BY ALIEN SPECIES (19) (conservation significance rating 5)

Overall Significance	A	B	C	D	E	Total
Length (km)	-	-	-	-	356.45	356.45

This vegetation type is by far the most common in the region, and consists of a wide range of exotic grasses and herbs occurring in a variety of combinations. Often dominated by *Critesion murinum* ssp. (barley grass), *Asphodelus fistulosus* (onion weed), *Carrichtera annua* (Ward's weed), *Echium plantagineum* (salvation Jane), *Avena barbata* (wild oats), *Lolium rigidum* (annual rye grass), *Bromus diandrus* (jabbers), *Salvia verbenaca* (wild sage), and *Plantago* spp. (plantains), this group is extremely variable. It occurs as an understorey to many of the shrublands and woodlands, though often exists without a higher stratum. There is generally little or no evidence of any native grasses or herbs present. Some of these exotic grasslands would originally have been shrublands and woodlands, and so many emergents (remnant) are often present. *Eucalyptus* spp. emergents can include *E. camaldulensis* (red gum), *E. odorata* (peppermint box), *E. leucoxylon* (blue gum) *E. socialis* (red mallee), *E .gracilis* (yorrell) and *E. porosa* (mallee box). Other emergents include *Acacia victoriae* (elegant wattle), *A. calamifolia* (wallowa), *A. pycnantha* (golden wattle), *Maireana pyramidata* (black bluebush) and *Senna artemisioides* ssp. (punty bush).

Plate 23 Ward's weed dominated roadside on Oladdie Road approx. 5 km east of Carrieton (54H 273953 6407181).

GRASSLAND DOMINATED BY ALIEN AND NATIVE SPECIES (20) (conservation significance rating 2)

Overall Significance	A	B	C	D	E	Total
Length (km)	-	-	19.55	60.4	-	79.95

Over much of the region, exotic grasses dominate the grasslands, and in areas where there is still evidence of some native species, though they may not be large populations, this category has been used. The rationale is that there may be seed sources still available to aid re-establishment of the native grasses if the competition from exotics is controlled. Native species prominent in this highly variable vegetation type include *Austrostipa* spp. (spear-grass) *Lomandra multiflora* ssp. *dura* (iron grass), *L. effusa* (scented iron grass), *Danthonia* spp. (wallaby grass) and *Chloris truncata* (windmill grass). Most exotics are described above, however *Avena barbata* (wild oats), and *Critesion murinum* ssp. (barley grass) are most common. Whilst *Lomandra* spp. are not actually "grasses", they were historically very common in grassy and grassy woodland vegetation types, much of which has been cleared or removed through agricultural and pastoral management practices.

Plate 24 Tufts of *Austrostipa* spp. grasses stand out in the nut grass and burr medic dominated roadside on Gumbowie Reservoir Road approx. 10 km south of Peterborough (54H 298969 6337446).

GRASSLAND DOMINATED BY NATIVE SPECIES (21) (conservation significance rating 1)

Overall Significance	A	B	C	D	E	Total
Length (km)	3.75	17.55	120.0	1.2	-	142.5

This grouping covers those areas where the populations of native grasses are certainly prominent, though not always dominant in terms of density, cover or biomass. There are usually still quite significant quantities of exotic grasses present. Due to the extremely dry conditions leading up to this survey, many areas where there were some indicator species still prominent were included in this group. This was an attempt to ensure that seasonally unfavourable conditions did not bias the survey data away from the ecologically important and threatened grassy and grassy woodland vegetation types, much of which has been cleared or removed through agricultural and pastoral management practices. Included in this group are the remnants of *Lomandra* spp. (iron grasses) *Austrostipa* spp. (spear grasses), *Themeda triandra* (kangaroo grass), *Danthonia* spp. (wallaby grasses), *Enneapogon nigricans* (black head grass), and in some areas *Chloris truncata* (windmill grass).

Plate 25 *Triodia scariosa* spp. dominates with exotic grasses on a low hillslope on Gorge Road approx. 3 km west of Yatina (54H 278554 6354958).

BARE GROUND OR BUILT-UP AREA (22)

Overall Significance	A	B	C	D	E	Total
Length (km)						13.3

Areas devoid of vegetation cover through paving, scalping, lawn planting, herbicide use and continuous property frontages are included in this category.

Figure 1 summarises graphically the proportions and absolute amounts of the described vegetation types noted during this survey (excluding TSA Roads from previous surveys).

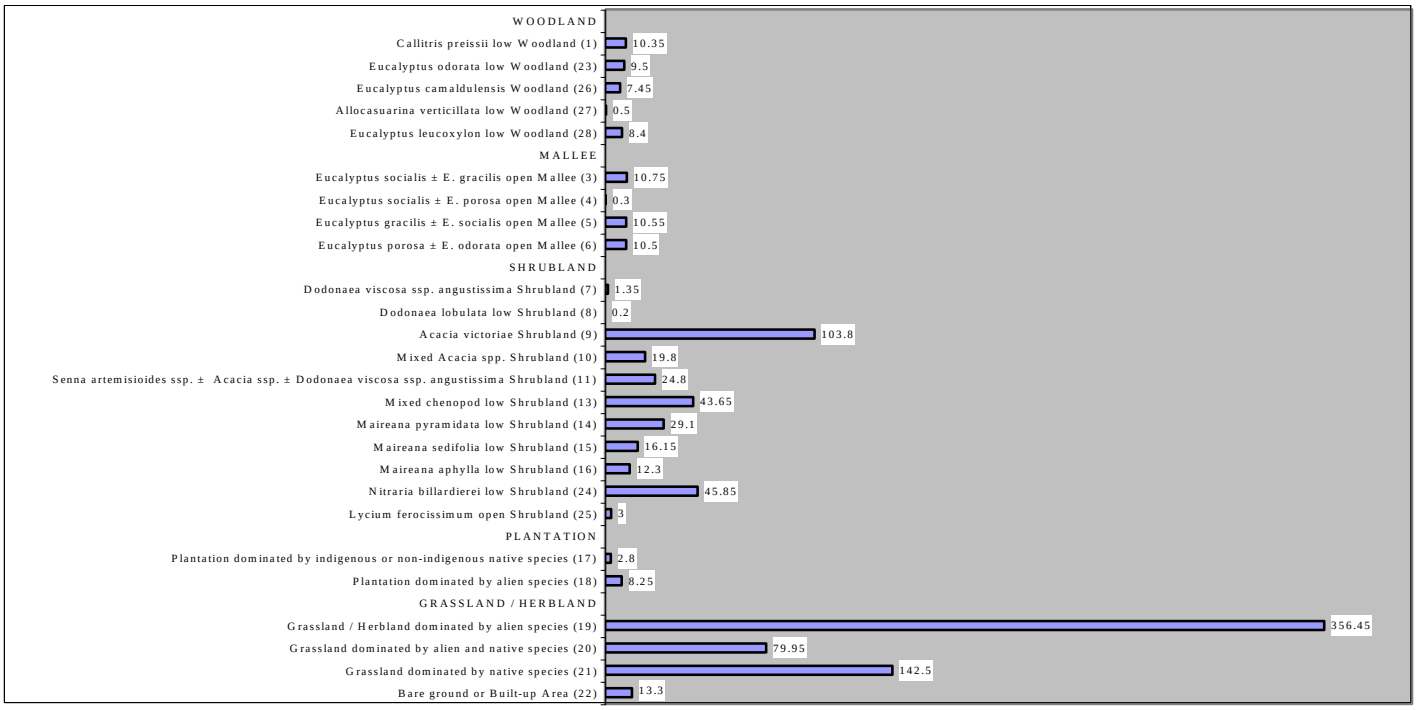


Figure 1 Summary of Vegetation Types described in the Orroroo/Carrieton roadside vegetation survey

3 SURVEY OUTCOMES

3.1 CONSERVATION SIGNIFICANCE AND MANAGEMENT IMPLICATIONS

Analysis of the data collected using this methodology enable only an assessment of the inherent ecological value of vegetation in roadside segments. It does not account for factors such as the relationship with other vegetation, value as a wildlife corridor or aesthetics. This inherent ecological value is expressed as an **Overall Significance** rating. The term **Condition** as used in this report, refers only to the extent of weed invasion (Table 2).

Table 2 Condition definitions for roadside segments.

1	*Excellent*	Very little or no sign of alien vegetation in the understorey; close resemblance to probable pre-European condition
2	*Good*	High proportion of native species and native cover in the understorey; reasonable representation of probable pre-European vegetation
3	*Moderate*	Substantial invasion of aliens, but native understorey persists; for example, may be a low proportion of native species and high native cover, or high proportion of native species and low native cover
4	*Poor*	The understorey consists predominantly of alien species, although a small number of natives persist
5	*Very poor*	The understorey consists only of alien species

There are three fields recorded for this attribute, Overview, Best and Worst for each segment.

3.1.1 OVERVIEW CONDITION SUMMARY

Statistics summarising the **Overview Condition** of the surveyed roads for the whole of the Orroroo/Carrieton District Council area including Transport SA surveys 7 and 8, are shown in Table 3. The **Overview Condition** is an "average condition" of the vegetation in a given segment regardless of vegetation type. A total of 703 km of roadsides were surveyed in the Orroroo/Carrieton District Council area in October 2002 (5.1 km was in built-up areas).

Table 3 Overview Condition Summary for Orroroo/Carrieton District Council area (including TSA surveys 7 and 8 and excluding built-up and bare ground).

Overview Condition	Length of surveyed LGA roadside (km)	Length of surveyed DTEI roadside (km)	% of total surveyed roadside length
1	0.0	0.0	0.0
2	2.45	6.3	0.92
3	31.00	30.6	6.36
4	134.95	64.9	20.65
5	529.50	168.1	72.07
Total	697.9	269.9	100

3.1.2 CONSERVATION SIGNIFICANCE OF VEGETATION ASSOCIATIONS

Neagle (1995) and Davies (1982) are key sources for determining the regional conservation significance of plant associations. These priority ratings concentrate on representation in reserves rather than regional remnancy or extent of threats. In addition the association names in Neagle (1995) and (Davies 1982) do not always coincide with associations defined elsewhere because this analysis includes exotic vegetation "associations" whereas Neagle (1995) and Davies (1982) covered only native vegetation types. Ultimately, the assigning of conservation significance ratings is based on available information on protection status Neagle

(1995), remnancy (i.e. extent relative to pre-European), and extent of threats, and must be assessed in a regional context.

Conservation significance of vegetation types in the Orroroo/Carrieton District Council area ranges from non-significant exotic vegetation to highly significant vegetation types such as native grasslands. Definitions for Regional Conservation Significance ratings are in Table 1 (p.9).

3.1.3 OVERALL SIGNIFICANCE

The **Overall Significance** rating for a roadside segment is derived from a combination of the **Regional Conservation Significance Rating** and its **Condition**, with every segment being assigned a category (A, B, C, D or E). This provides a simple, partially objective ranking of the relative ecological value of vegetation in each segment.

Table 4 Matrix of **Overall Significance** values, as determined by the vegetation association conservation significance and the overview condition of the vegetation. For **Regional Conservation Significance**, rating 1 represents the highest conservation value. For **Condition**, rating 1 represents the best condition (least weed invaded). For **Overall Significance**, A represents the most sensitive (ecologically most important) vegetation. Brackets indicate that this combination is unlikely to occur.

Condition	Regional Conservation Significance Rating				
	1	**2**	**3**	**4**	**5**
1	**A**	**A**	**B**	**(C)**	**(C)**
2	**A**	**B**	**B**	**(C)**	**(D)**
3	**B**	**B**	**C**	**D**	**(D)**
4	**C**	**C**	**D**	**E**	**E**
5	**C**	**D**	**D**	**E**	**E**

Table 5 Overall Significance Summary for roadsides surveyed in the Orroroo/Carrieton District Council area (including TSA surveys 7 and 8 and excluding built-up and bare ground).

Overall Significance	Length of surveyed LGA roadside (km)	Length of surveyed DTEI roadside (km)	% of total surveyed roadside length
A	0.2	3.55	0.39
B	12.8	26.75	4.09
C	148.95	40.5	19.58
D	274.75	83.4	37.00
E	261.2	115.7	38.94
Total	697.9	269.9	100

3.1.4 MANAGEMENT CATEGORIES

Overall Significance ratings relate almost directly to **Management Categories**. In general terms **Management Categories** A to E apply to roadside segments that have been surveyed and assigned **Overall Significance** A to E (Map 5).

This study ranked 5 roadside segments totalling 3.75 km (0.39 % of roads surveyed) as appropriate for **Management Category A**, and a further of segments totalling 39.55 km (4.09% of roads surveyed) suitable for **Management Category B**. A further 11.95 km of roadsides with **Overall Significance C** are assigned to **Management Category B** on the basis of a **Best Condition rating of 1 or 2**.

The segment numbers refer to the datasheets where all other data items are listed and left/right refers to the roadside in the direction of travel (Map 2 "Roads Surveyed"). Roadside segment start, finish, length and width are also noted. Many of these areas may be suitable for special management attention such as "Bushcare" sites. These can be ranked on the basis of the regional conservation significance of vegetation type. Regional conservation rankings are denoted by the bracketed numbers (see Table 1, p9) after the vegetation type.

3.1.4.1 ROADSIDE SEGMENTS RECOMMENDED FOR CATEGORY A MANAGEMENT

Murray Town – Orroroo Road (R8-2)

30 L 21600-22450 850 <6m
Austrostipa blackii Tussock grassland (1)
30 R 21600-22450 850 <6m
Austrostipa blackii Tussock grassland (1)
46 R 37700-39550 1 850 >15m
Austrostipa blackii Tussock grassland (1) REF

Boundary Road (R49-7)

8 L 2300-2400 100 <6m
Grassland dominated by native species (1)
8 R 2300-2400 100 <6m
Grassland dominated by native species (1)

3.1.4.2 ROADSIDE SEGMENTS RECOMMENDED FOR CATEGORY B MANAGEMENT

Crocker Hill Road (R49-4)

5 L 4300-4400 100 6-15m
Allocasuarina verticillata low Woodland (3)

Boundary Road (R49-7)

9 L 2400-2650 250 <6m
Senna artemisioides ssp.±*Acacia* ssp.±*Dodonaea viscosa* ssp. *angustissima*±*Eremophila longifolia* Shrubland (3)
9 R 2400-2650 250 <6m
Senna artemisioides ssp.±*Acacia* ssp.±*Dodonaea viscosa* ssp. *angustissima*±*Eremophila longifolia* Shrubland (3)
11 L 3000-3150 150 <6m
Grassland dominated by native species (1)
11 R 3000-3150 150 <6m
Grassland dominated by native species (1)
15 R 3850-4100 250 <6m
Grassland dominated by native species (1)
16 R 4100-4200 100 <6m
Grassland dominated by native species (1)

Murray Town – Orroroo Road (R8-2)

27 L 19850-21050 1200 <6m
Austrostipa eremophila Tussock grassland (2)
27 R 19850-21050 1200 <6m
Austrostipa eremophila Tussock grassland (2)
29 L 21350-21600 250 <6m
Senna spp. Shrubland (3)
29 R 21350-21600 250 <6m
Senna spp. Shrubland (3)
31 L 22450-22650 200 <6m
Austrostipa blackii Tussock grassland (1)
31 R 22450-22650 200 <6m
Callitris preissii Woodland (2)
35 L 25250-25650 400 <6m
Austrostipa blackii Tussock grassland (1)
35 R 25250-25650 400 <6m
Austrostipa blackii Tussock grassland (1)
43 L 35200-35650 450 >15m
Austrostipa blackii Tussock grassland (1)
43 R 35200-35650 450 6-15m
Danthonia caespitosa Tussock grassland (1)
51 R 44450-44900 450 >15m
Eucalyptus porosa / Eucalyptus gracilis Low woodland (3)
56 R 47600-48000 400 6-15m
Acacia calamifolia Shrubland (3)
57 L 48000-48300 300 >15m
Eucalyptus porosa / Eucalyptus gracilis Low woodland (3)
57 R 48000-48300 300 >15m
Eucalyptus porosa / Eucalyptus gracilis Low woodland (3)
58 L 48300-48600 300 >15m
Senna spp. Shrubland (3)
58 R 48300-48600 300 >15m
Eucalyptus gracilis Mallee (3)

Bully Acre Road (R49-10)

5 L 3950-4100 150 <6m
Grassland dominated by native species (1)
5 R 3950-4100 150 <6m
Grassland dominated by native species (1)
6 R 4100-4150 50 <6m
Grassland dominated by native species (1)
14 L 7900-8150 250 <6m
Grassland dominated by native species (1)
14 R 7900-8150 250 <6m
Grassland dominated by native species (1)
16 L 8550-8900 350 <6m
Grassland dominated by native species (1)

Narien Road (R49-11)

5 L 750-950 200 <6m
Grassland dominated by native species (1)
14 L 3300-3900 600 <6m
Grassland dominated by native species (1)
18 L 4750-4900 150 <6m
Grassland dominated by native species (1)
19 L 4900-5050 150 <6m
Grassland dominated by native species (1)

Oladdie Road (R49-22)

26 R 11900-12100 200 6-15m
Eucalyptus socialis ± *E. gracilis* open Mallee (3)
27 L 12100-12600 500 <6m
Eucalyptus socialis ± *E. gracilis* open Mallee (3)
27 R 12100-12600 500 6-15m
Eucalyptus socialis ± *E. gracilis* open Mallee (3)

Gorge Road (R49-31)

10 L 3750-3900 150 <6m
Eucalyptus porosa ± *E. odorata* open Mallee (2)
10 R 3750-3900 150 <6m
Eucalyptus porosa ± *E. odorata* open Mallee (2)
11 L 3900-5250 1350 <6m
Eucalyptus porosa ± *E. odorata* open Mallee (2)
11 R 3900-5250 1350 <6m
Eucalyptus porosa ± *E. odorata* open Mallee (2)
13 L 5500-5950 450 <6m
Eucalyptus porosa ± *E. odorata* open Mallee (2)
13 R 5500-5950 450 <6m
Eucalyptus porosa ± *E. odorata* open Mallee (2)
28 R 9700-9800 100 <6m
Eucalyptus odorata low Woodland (1)
30 L 9950-10200 250 <6m
Eucalyptus odorata low Woodland (1)
30 R 9950-10200 250 <6m
Eucalyptus odorata low Woodland (1)
32 L 10350-11150 800 <6m
Eucalyptus porosa ± *E. odorata* open Mallee (2)
32 R 10350-11150 800 <6m
Eucalyptus porosa ± *E. odorata* open Mallee (2)

Black Rock – Clare (R8-1 Transport SA road)

3 R 1100-1400 300 >15m
Plantation over native tussock grassland (2)

Mid Nth Boundary – Orroroo Road (R8-10 Transport SA road)

1 L 0-3000 3000 >15m
Atriplex stipitata Low shrubland (2)
1 R 0-3000 3000 >15m
Atriplex stipitata Low shrubland (2)
2 L 3000-3400 400 >15m
Atriplex stipitata Low shrubland (2)
2 R 3000-3400 400 >15m
Atriplex stipitata Low shrubland (2)
3 L 3400-3600 200 >15m
Austrostipa eremophila Tussock grassland (2)
4 L 3600-4000 400 >15m
Austrostipa eremophila Tussock grassland (2)
4 R 3600-4000 400 >15m
Austrostipa eremophila Tussock grassland (2)
16 R 14000-15450 1450 >15m
Plantation over native tussock grassland (2)
16 L 14000-15450 1450 >15m
Plantation over native tussock grassland (2)

Murray Town – Orroroo Road (R8-2)

32 L 22650-23800 1150 <6m
Austrostipa blackii Tussock grassland (1)
32 R 22650-23800 1150 <6m
Austrostipa blackii Tussock grassland (1)
33 R 23800-24600 800 6-15m
Austrostipa blackii Tussock grassland (1)
42 R 32150-35200 3050 <6m
Austrostipa blackii Tussock grassland (1)
46 L 37700-39550 1850 >15m
Austrostipa blackii Tussock grassland (1)
49 R 42150-43050 900 >15m
Danthonia caespitosa Tussock grassland (1)
55 R 47100-47600 500 >15m
Eucalyptus porosa Low woodland (2)
59 R 48600-48750 150 >15m
Eucalyptus porosa Low woodland (2)

Orroroo Ucolta Road (R8-9 Transport SA road)

5 R 2850-3550 700 >15m
Plantation over native tussock grassland (2)

Eurelia West Road (R49-15)

13 R 5150-5500 350 <6m
Grassland dominated by native species (1)

McCallum Road (R49-2)

3 L 400-800 400 <6m
Grassland dominated by native species (1)

Crocker Hill Road (R49-4)

6 L 4400-5000 600 <6m
Grassland dominated by native species (1)
6 R 4400-5000 600 <6m
Grassland dominated by native species (1)

3.1.4.3 ROADSIDE SEGMENTS RECOMMENDED FOR CATEGORY B MANAGEMENT (OVERALL SIGNIFICANCE "C" WITH BEST CONDITION OF "1" OR "2")

Murray Town – Orroroo Road (R8-2)

28 L 21050-21350 300 <6m
Acacia victoriae Tall shrubland (3)
28 R 21050-21350 300 >15m
Acacia victoriae Tall shrubland (3)
39 L 28150-29300 1150 <6m
Austrostipa nitida Tussock grassland (3)
39 R 28150-29300 1150 >15m
Austrostipa nitida Tussock grassland (3)

Wilmington – Ucolta Road (R7-3 Transport SA road)

37 L 31000-31600 600 >15m
Senna artemisioides ssp. Shrubland (3)

Pekina Black Rock Road (R49-12)

8 R 4450-4550 100 <6m
Senna artemisioides ssp.±*Acacia* ssp.±*Dodonaea viscosa* ssp. *angustissima*±*Eremophila longifolia* Shrubland (3)

McCallum Road (R49-2)

2 R 300-400 100 <6m
Dodonaea viscosa ssp. *angustissima* Shrubland (3)
8 R 1600-1900 300 <6m
Senna artemisioides ssp.±*Acacia* ssp.±*Dodonaea viscosa* ssp. *angustissima*±*Eremophila longifolia* Shrubland (3)
9 L 1900-2000 100 <6m
Eucalyptus leucoxylon low Woodland (3)
9 R 1900-2000 100 <6m
Eucalyptus leucoxylon low Woodland (3)
10 L 2000-2100 100 <6m
Senna artemisioides ssp.±*Acacia* ssp.±*Dodonaea viscosa* ssp. *angustissima*±*Eremophila longifolia* Shrubland (3)
10 R 2000-2100 100 <6m
Senna artemisioides ssp.±*Acacia* ssp.±*Dodonaea viscosa* ssp. *angustissima*±*Eremophila longifolia* Shrubland (3)
11 L 2100-2500 400 <6m
Eucalyptus socialis ± *E. gracilis* open Mallee (3)
11 R 2100-2500 400 <6m
Eucalyptus socialis ± *E. gracilis* open Mallee (3)

Yalpara Road (R49-25)

3 L 2150-5500 3350 >15m
Mixed chenopod low Shrubland (3)
3 R 2150-5500 3350 >15m
Mixed chenopod low Shrubland (3)

Gorge Road (R49-31)

6 R 3000-3200 200 >15m
Eucalyptus porosa ± *E. odorata* open Mallee (2)
14 L 5950-6100 150 <6m
Eucalyptus socialis ± *E. gracilis* open Mallee (3)

Crocker Hill Road (R49-4)

4 R 4100-4300 200 <6m
Allocasuarina verticillata low Woodland (3)
5 R 4300-4400 100 <6m
Mixed *Acacia* spp. Shrubland (3)

Boundary Road (R49-7)

4 L 1600-1750 150 <6m
Senna artemisioides ssp.±*Acacia* ssp.±*Dodonaea viscosa* ssp. *angustissima*±*Eremophila longifolia* Shrubland (3)

4 R 1600-1750 150 <6m
Senna artemisioides ssp.±*Acacia* ssp.±*Dodonaea viscosa* ssp. *angustissima*±*Eremophila longifolia* Shrubland (3)

7 L 2150-2300 150 <6m
Senna artemisioides ssp.±*Acacia* ssp.±*Dodonaea viscosa* ssp. *angustissima*±*Eremophila longifolia* Shrubland (3)

7 R 2150-2300 150 <6m
Senna artemisioides ssp.±*Acacia* ssp.±*Dodonaea viscosa* ssp. *angustissima*±*Eremophila longifolia* Shrubland (3)

10 L 2650-3000 350 <6m
Senna artemisioides ssp.±*Acacia* ssp.±*Dodonaea viscosa* ssp. *angustissima*±*Eremophila longifolia* Shrubland (3)

10 R 2650-3000 350 <6m
Senna artemisioides ssp.±*Acacia* ssp.±*Dodonaea viscosa* ssp. *angustissima*±*Eremophila longifolia* Shrubland (3)

12 L 3150-3550 400 <6m
Senna artemisioides ssp.±*Acacia* ssp.±*Dodonaea viscosa* ssp. *angustissima*±*Eremophila longifolia* Shrubland (3)

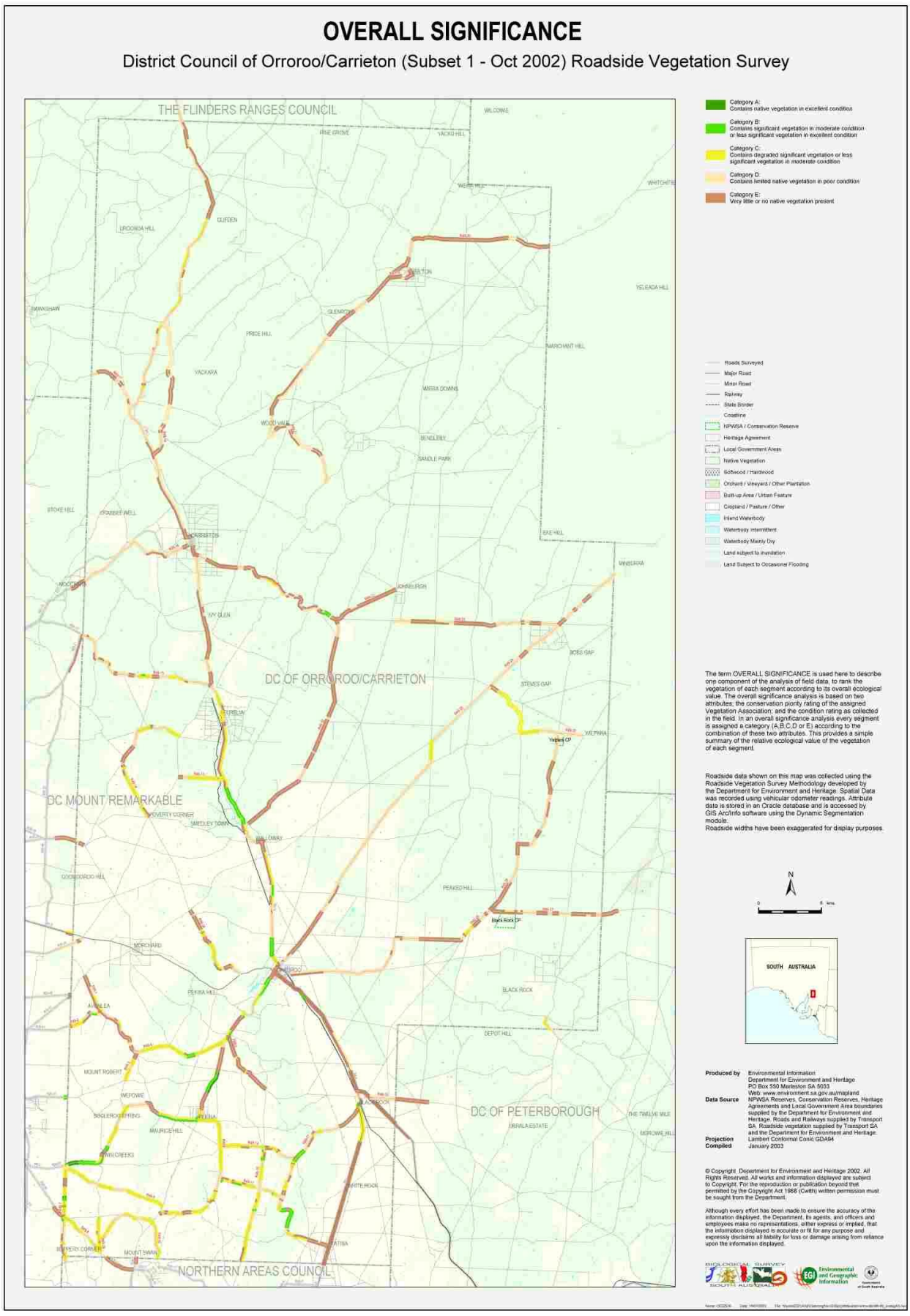
12 R 3150-3550 400 <6m
Senna artemisioides ssp.±*Acacia* ssp.±*Dodonaea viscosa* ssp. *angustissima*±*Eremophila longifolia* Shrubland (3)

16 L 4100-4200 100 <6m
Mixed Acacia spp. Shrubland (3)

18 L 4300-4600 300 <6m
Senna artemisioides ssp.±*Acacia* ssp.±*Dodonaea viscosa* ssp. *angustissima*±*Eremophila longifolia* Shrubland (3)

25 L 7200-7400 200 <6m
Mixed *Acacia* spp. Shrubland (3)

25 R 7200-7400 200 <6m
Mixed *Acacia* spp. Shrubland (3)



Map 5 Orroroo/Carrieton District Council - Roadside Vegetation Management Categories

In general terms, actions listed below for **Management Categories** A to E apply to roadside segments that have been surveyed and assigned an **Overall Significance** of A to E. The only exception is on roadsides that have been assigned an Overall Significance of C but they do contain some good condition native vegetation (i.e. **Best Condition** 1 or 2). These segments should be treated as Management Category B. Roadside **Overall Significance Categories** are shown on Map 5. Table modified from (Reynolds 2000)

Table 6 Management for roadsides of different management categories

DEFINITION	Overall Significance / Management Category				
	A	**B**	**C**	**D**	**E**
1. Value 2. Restrictions	VERY HIGH value. Many restrictions apply	HIGH value. Restrictions apply	HIGH value. Restrictions apply	MODERATE value. Some restrictions apply	MODERATE-LOW values. Some restrictions may apply
	ROADSIDE MANAGEMENT RESTRICTIONS				
GENERAL	AVOID ALL disturbance outside shoulder	AVOID ALL disturbance outside shoulder	LIMIT disturbance outside shoulder to designated sites	LIMIT disturbance outside shoulder to designated sites	MINIMISE general disturbance outside shoulder
Marking	Standard signs and list on register of roadside significant sites	Standard signs and list on register of roadside significant sites	Not marked	Not marked	Not marked
Stockpiling	NOT PERMITTED	AVOID	AVOID	Select site with care	No restrictions
Borrow pits	NOT PERMITTED	AVOID	AVOID	Select site with care	No restrictions
Table drains (sealed)	DO NOT spray or grade	DO NOT grade Selectively spray	DO NOT grade Selectively spray	DO NOT grade Selectively spray	LIMIT grading or spraying if possible
Table drains (unsealed)	Grade carefully as required. MINIMISE DISTURBANCE	Grade carefully as required. MINIMISE DISTURBANCE	Grade as required. MINIMISE DISTURBANCE	Grade as required. MINIMISE DISTURBANCE	Grade as required. MINIMISE DISTURBANCE
Shoulder widening	AVOID	AVOID	LIMIT	LIMIT if possible	No restrictions
Shoulder maintenance	REMOVE grading spoil Spray with caution (limit to furniture)	REMOVE grading spoil Spray with caution (limit to furniture)	REMOVE grading spoil Spray with care (limit to furniture)	REMOVE grading spoil Spray with care	No restrictions
Drain turn-outs (sealed)	DO NOT grade. Cut or excavate only. Obtain approval for new drains.	DO NOT grade. Cut or excavate only.	DO NOT grade. Cut or excavate only.	MINIMISE graded turn-outs	MINIMISE graded turn-outs where possible
Drain turn-outs (unsealed)	Only where necessary. MINIMISE DISTURBANCE	Only where necessary. MINIMISE DISTURBANCE	No restrictions. MINIMISE DISTURBANCE	No restrictions. MINIMISE DISTURBANCE	No restrictions. MINIMISE DISTURBANCE
Vegetation control	LIMIT to 0.5m guidepost offset REMOVE pruning debris DO NOT spray or grade	LIMIT to 0.5m guidepost offset REMOVE pruning debris DO NOT spray or grade	LIMIT to 0.5m guidepost offset REMOVE pruning debris DO NOT grade	LIMIT to 1.0m guidepost offset SCATTER pruning debris in open areas - do not pile up DO NOT grade	No restrictions
Service Installation	AVOID	AVOID	AVOID /select disturbed sites	Select disturbed sites	No restrictions

DEFINITION	Overall Significance / Management Category				
	A	**B**	**C**	**D**	**E**
1. Value 2. Restrictions	VERY HIGH value. Many restrictions apply	HIGH value. Restrictions apply	HIGH value. Restrictions apply	MODERATE value. Some restrictions apply	MODERATE-LOW values. Some restrictions may apply
	ROADSIDE		MANAGEMENT	RESTRICTIONS	
Service Maintenance	LIMIT disturbance to a minimum & prepare site protection plan	LIMIT disturbance to a minimum & prepare site protection plan	LIMIT disturbance to a minimum & prepare site rehabilitation plan	Rehabilitate sites	Rehabilitate sites
Revegetation	AVOID	AVOID	LIMITED reinforcement planting may be OK	Reinforcement planting OK in open areas	Broad-acre revegetation with local indigenous species suitable
Seed Collection	ONLY with special permission	Limited collection with permit	Limited collection with permit	Limited collection with permit	Limited collection with permit
Firewood Collection	NOT PERMITTED	NOT PERMITTED	NOT PERMITTED	NOT PERMITTED	NOT PERMITTED
Rubbish Dumping	NOT PERMITTED	NOT PERMITTED	NOT PERMITTED	NOT PERMITTED	NOT PERMITTED
Fire Management	AVOID	AVOID	AVOID / slash breaks if essential	Slash breaks in preference to grading	No restrictions
Pest Plant Control	TARGETTED removal by Bushcare only	TARGETTED removal by Bushcare only	Spot spraying of target species	Spot spraying of target species	No restrictions
Stock grazing	NOT PERMITTED	NOT PERMITTED	AVOID	AVOID	AVOID
Stock Movement	AVOID	AVOID	MOVE quickly Clean vehicles	MOVE quickly Clean vehicles	No restrictions
Fenceline clearance	Minimise disturbance	Minimise disturbance	Minimise disturbance	No restrictions	No restrictions
Fertiliser / Herbicide drift	AVOID	AVOID	AVOID	AVOID	AVOID
Off-road access (parking, turning, detour)	AVOID all access off shoulder	AVOID all access off shoulder	LIMIT access off shoulder to previously disturbed sites	LIMIT access off shoulder to previously disturbed sites	No restrictions
Parking bays	NOT PERMITTED	AVOID	AVOID	Select disturbed sites	No restrictions

4 DISCUSSION

4.1 CONSERVATION SIGNIFICANCE

4.1.1 CONSERVATION STATUS OF PLANT ASSOCIATIONS

Some plant associations found in the Orroroo/Carrieton District Council area are rare and endangered, or poorly conserved in South Australia or Australia. Each association listed below has been given a priority rating for conservation by either Davies (1982) or Neagle (1995).

4.1.1.1 LOMANDRA EFFUSA ± LOMANDRA MULTIFLORA SPP. *DURA OPEN TUSSOCK GRASSLAND*

Davies (1982) reports *Lomandra effusa* (scented mat rush) ± *L. multiflora* spp. *dura* (iron grass) open tussock grassland as being priority 1 (very rare and endangered with no conservation in South Australia). This particular association referred to is typified in the mid-North of South Australia and described in Stephens (1945), Jessup (1948) and Specht and Perry (1948). In the mid-North, these remnants only exist now because the extremely shallow soils with outcropping rocks make cultivation for agriculture impossible. Regionally therefore, any occurrence of this association is extremely important for conservation. All occurrences of either species were considered to be potential remnants and were assigned to a high conservation value vegetation grouping. The seasonally dry conditions have placed sever stresses on all vegetation types, and in an attempt to ensure that these remnants were not biased against in the data collection, their presence, rather than their vigour or density was used as an indicator.

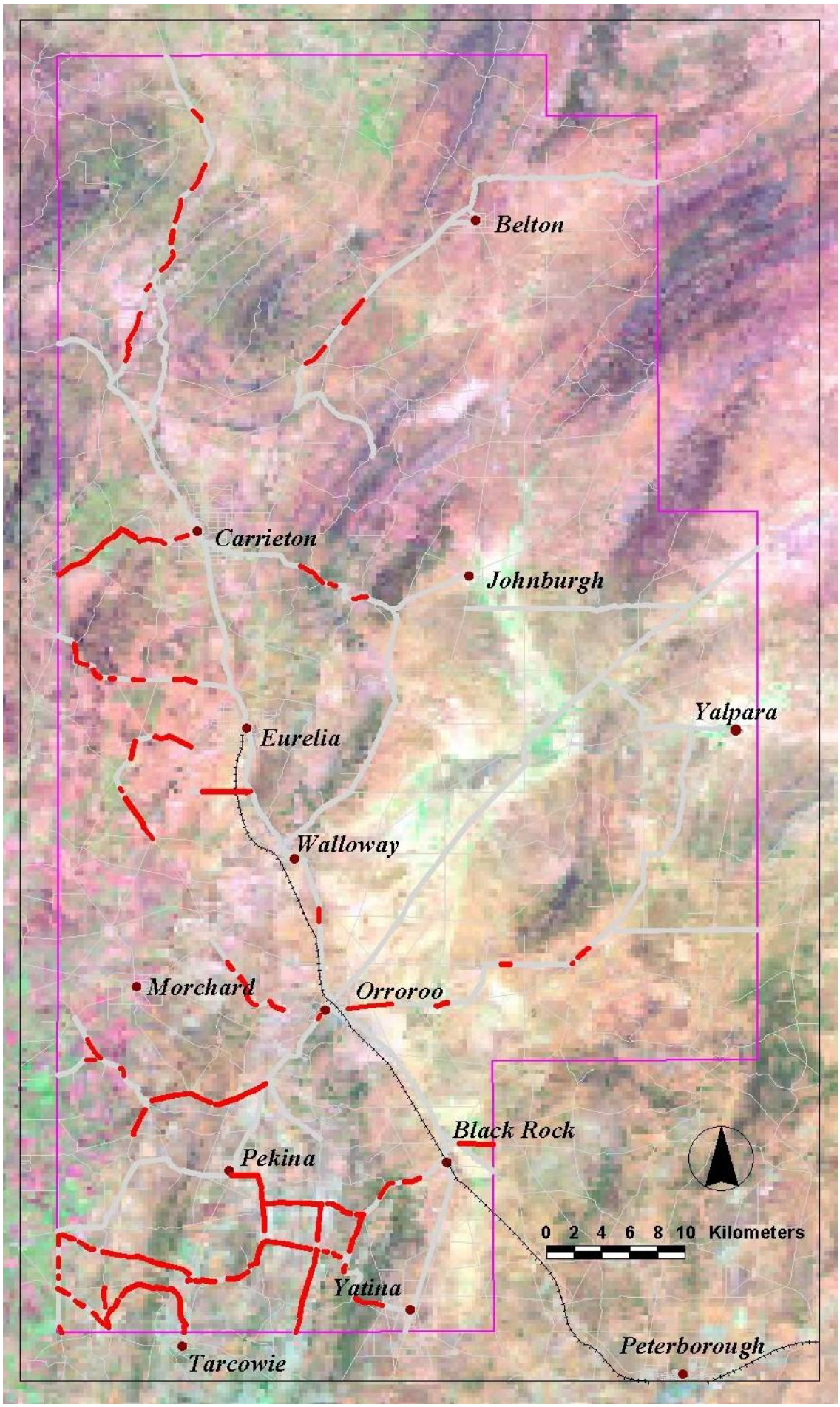
4.1.1.2 EUCALYPTUS ODORATA ± E. POROSA LOW WOODLAND

Eucalyptus odorata (peppermint box) ± *E. porosa* (mallee box) Low Woodland is listed by(Davies 1982) as being poorly conserved in South Australia with most examples being small, degraded or atypical (Priority 4). Neagle (1995) gives it the same rating, indicating little change in the interim. The study area is on the eastern and northern edge of the range for *E. odorata* and this association probably represents an ecotone or transition into the drier mallee environments that support *E. porosa*. In the Mount Lofty Ranges, it is considered poorly conserved and in the Orroroo/Carrieton District Council area it is uncommon. Care should be exercised in revegetation projects to ensure that *E. odorata* is not being introduced into inappropriate areas.

4.1.1.3 NATIVE GRASS ASSOCIATIONS

Some plant associations found in the Orroroo/Carrieton Council Area are rare and endangered, or are poorly conserved in South Australia or Australia. Native grasslands and sedgelands are not common as the dominant association type in the District. However there are significant native grass populations throughout the area. Dominant grass and sedgelands and noted significant grass areas are shown on Map 6 "Significant Areas of Native Grasses". The background satellite image helps to show the relationship between the grass areas and the regional topography. The areas noted are roadside segments where native grasses are either prominent or still present in sufficient quantities to regenerate if exotic competition is controlled.

Grassland remnants on roadsides, parklands and other minor reserves under Council control are often the only areas where significant plant species, threatened at the national level can be found. The lack of awareness of native grassy vegetation and its value means that their survival is particularly threatened. The Mid North Grasses Advisory Group is dedicated to the management and enhancement of native grass communities and, in cooperation with other conservation groups, has been raising community awareness and understanding of these threatened plant associations.



Map 6 Orroroo/Carrieton District Council - Significant Areas of Native Grass populations

4.1.2 CONSERVATION STATUS OF PLANT SPECIES

No occurrences of plants listed as threatened in the Eastern Botanical Regions were noted during the drive-by survey. More extensive searching at different times of the year will almost certainly enable the discovery of some. These ratings are assigned on a regional basis and known distribution of plants in the District as related to the entire Eastern region limits their applicability. Some species may be listed as uncertain, uncommon or rare, purely because of the small amount of habitat available to them. The most important aspect of this is whether the habitat available to them is being degraded and destroyed through inappropriate management or not. The current complete extensive list of threatened plant species for the Eastern region is in Appendix A.

4.1.2.1 EUCALYPTUS ODORATA (PEPPERMINT BOX)

E. odorata is listed by Neagle (1995) as "poorly conserved in South Australia, with most remaining examples being small and/or degraded and/or atypical"

4.1.3 NATIONALLY THREATENED ECOLOGICAL COMMUNITIES

Some ecological communities found in the Orroroo/Carrieton District Council area are listed as critically endangered under the Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999*. Each ecological community listed below is classified as critically endangered and may occur within the District. These ecological communities are extremely important for conservation and therefore their occurrence on roadsides requires management as for Management Category A.

4.1.3.1 EUCALYPTUS ODORATA (PEPPERMINT BOX) *GRASSY WOODLAND OF SOUTH AUSTRALIA*

Peppermint Box Grassy Woodlands are unique to South Australia and *may* occur in this District. Peppermint Box *(Eucalyptus odorata)* is the dominant species of the tree canopy, characterised by a single main trunk at the base with low branches. Other tree species present may include: Grey Box *(E. micropcarpa);* South Australian Blue Gum *(E. leucoxylon);* Sugar Gum *(E.cladocalyx);* Mallee Box *(E. porosa);* Droopind Sheoak *(Allocasuarina verticillata);* White Cypress-pine *(Callitris glaucophylla);* and Southern Cypress-pine *(C. preissii).* The grasses and herbs likely to occur include Wallaby Grasses *(Austrodanthonia spp.),* Spear Grasses *(Austropstipa spp.),* Iron-grasses *(Lomandra spp.)* and Black-anther Flax Lily *(Dianella revoluta).*

4.1.3.2 IRON-GRASS NATURAL TEMPERATE GRASSLAND OF SOUTH AUSTRALIA

Iron-grass Grasslands are unique to South Australia and *may* occur in this District. The Iron-grass Natural Temperate Grassland is dominated by Iron-grasses *(Lomandra multiflora ssp. dura* and/or *Lomandra effusa),* with tussock-forming grasses, low shrubs and other native plants in the ground layer. Trees and tall shrubs are generally absent or very sparse (less than 10% cover).

4.2 WEED INVASION

By definition, a weed or pest plant is any plant growing in a place where it is not wanted, and whether a plant is native or not does not necessarily define it as a weed. There are many Australian plants, which for many good reasons have been incorporated in plantations on roadsides. Some of these plants have the potential to spread and affect other populations of local native plants. Robertson (1994) describes and lists many of the relevant weeds and gives recommendations on control. Weeds compete with native plants for light, soil moisture and nutrients and particularly after some disturbance, can affect native populations severely.

Roadsides, due to their linear nature are also susceptible to invasions of weeds from the adjoining land. In roadsides adjacent to larger patches of native vegetation, these "edge effects" are less severe, and weed control programs may be more effective. They are also corridors along which weeds or their propagules can be spread, just through vehicular traffic and general maintenance activities.

Some highly invasive exotic grasses are not "proclaimed plants" under the Animal and Plant Control (Agricultural Protection and other Purposes) Act, 1986 and have in effect no possible mechanisms for enforcement of control measures. Wild oats and barley grass, apart from being highly invasive, can also be a fire hazard and a wool contaminant.

4.2.1 WEEDS OF NATIONAL SIGNIFICANCE

The following invasive species, listed as Weeds of National Significance (WoNS) by the Department of Water, Heritage and the Arts, *are likely to* occur in this District:

- Bridal Creeper, *Asparagus asparagoides.*

The following invasive species, listed as WoNS, *may* occur in this District:

- Boneseed, *Chrysanthemoides monilifera,*
- Blackberry, *Rubus fruticosus.*
- Gorse, *Ulex Europeans.*

Distribution maps such as those on the following pages can assist with the planning of weed control programs, bearing in mind that the roadside weed inventory collected through the drive-by survey is not comprehensive. Distributions of thirteen of the more problematical weeds are shown on Maps 7 to 19 (Table 7).

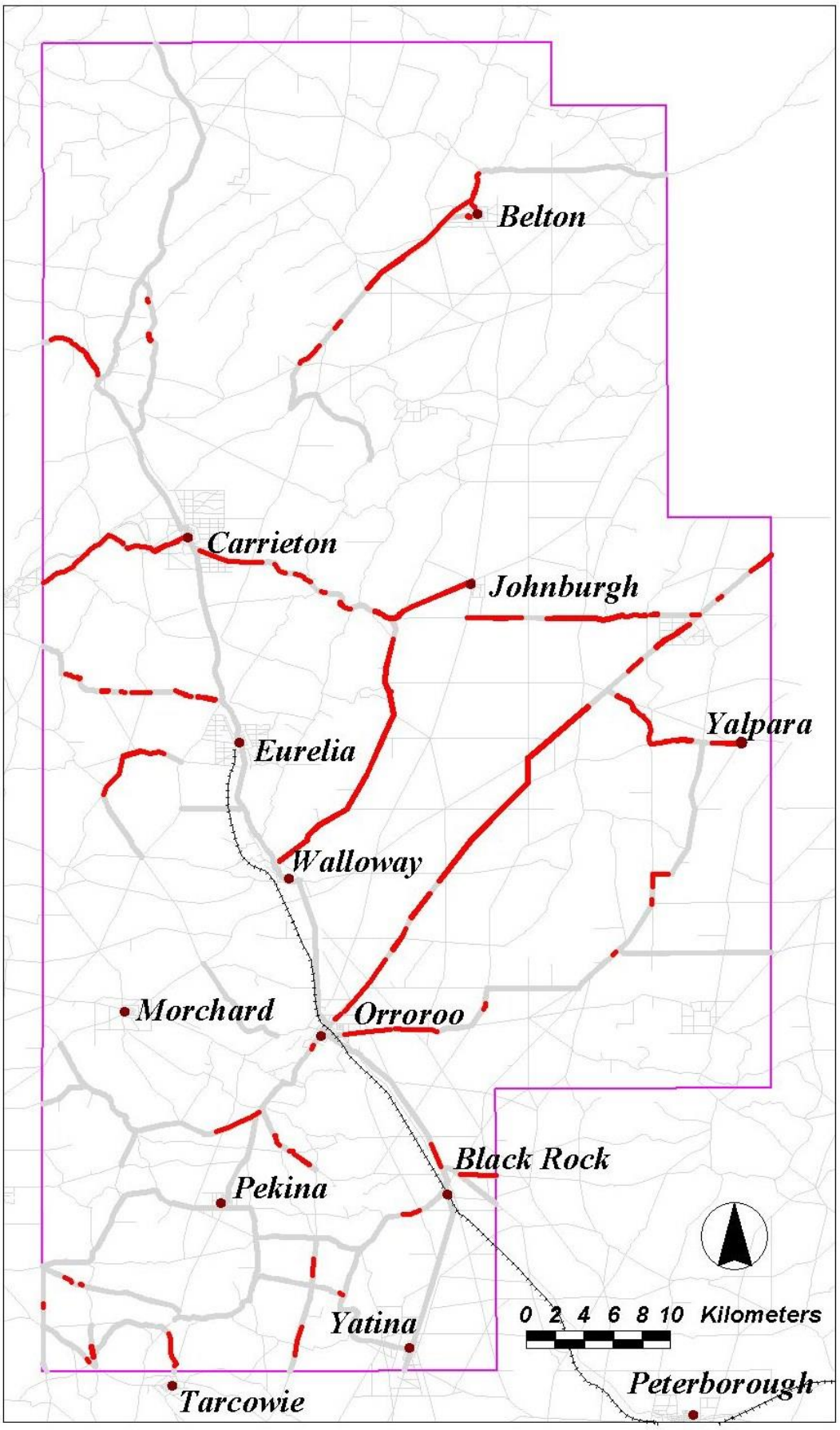
Table 7 List of Weed Distribution maps

7 African boxthorn	*Lycium ferocissimum*
8 African rue	*Peganum harmala*
9 Bathurst burr	*Xanthium spinosum*
10 dog rose	*Rosa canina*
11 horehound	*Marrubium vulgare*
12 Lincoln weed	*Diplotaxis tenuifolia*
13 onion weed	*Asphodelus fistulosus*
14 pepper tree	*Schinus areira*
15 saffron thistle	*Carthamus lanatus*
16 salvation jane	*Echium plantagineum*
17 star thistle	*Centaurea calcitrapa*
18 stemless thistle	*Onopordum acaulon*
19 wild artichoke	*Cynara cardunculus*

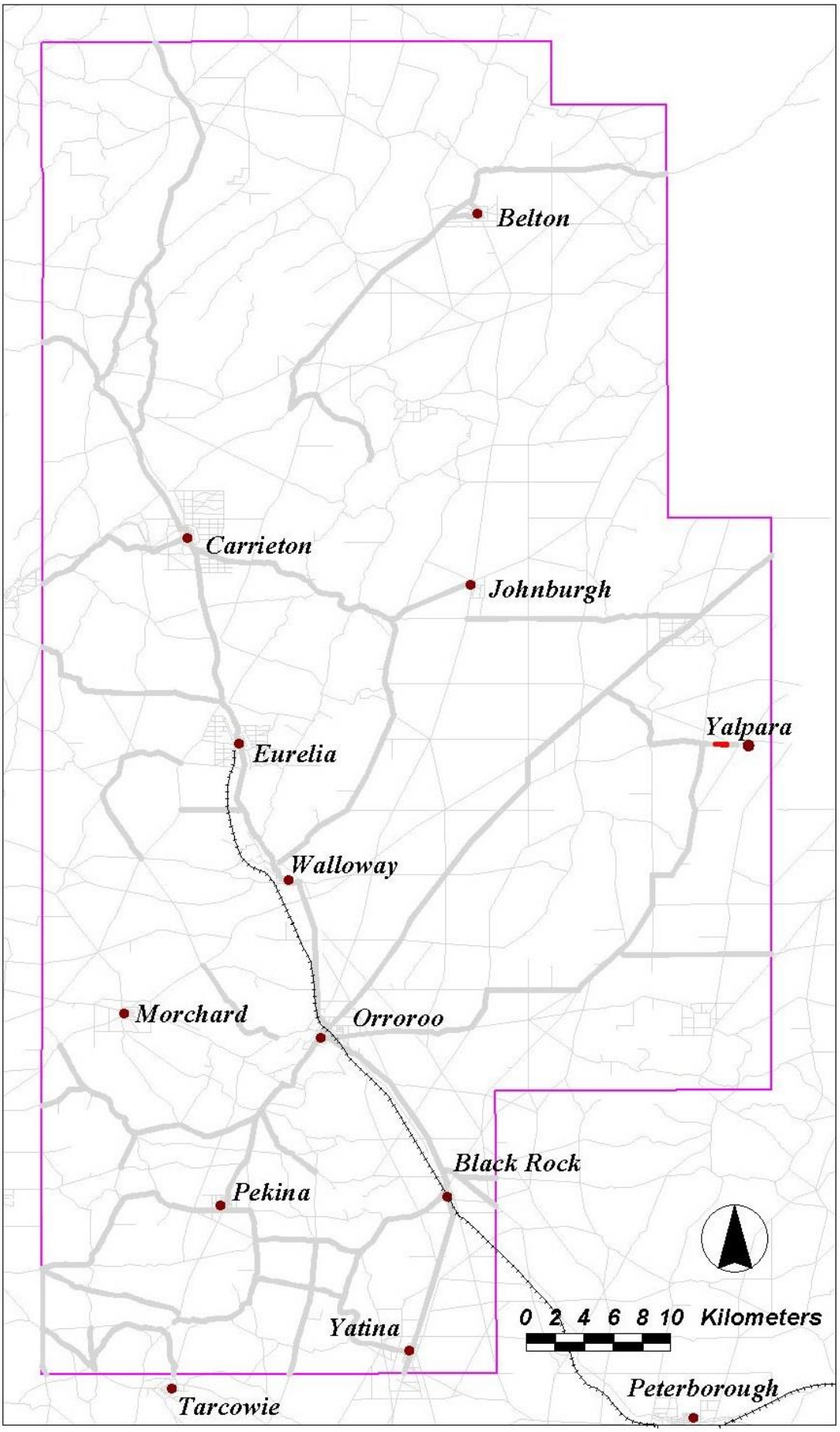
Other weeds listed in the data are:

Aaron's rod	*Verbascum thapsus*
aloe	*Aloe saponaria*
bamboo	*Arundo donax*
barley grass	*Critesion murinum* ssp. *glaucum*
buckthorn plantain	*Plantago lanceolata*
bulbous meadow-grass	*Poa bulbosa*
burr medic	*Medicago sp.*
capeweed	*Arctotheca calendula*
chicory	*Cichorium intybus*
common peppercress	*Lepidium africanum*
curled dock	*Rumex crispus*
cut leaf mignonette	*Reseda lutea*
date palm	*Phoenix dactylus*
fennel	*Foeniculum vulgare*
hare's-foot clover	*Trifolium arvense*
nut grass	*Gynandriris setifolia*
pine	*Pinus sp.*
prickly pear	*Opuntia stricta*
rice millet	*Piptatherum miliaceum*
rocket	*Sisymbrium erysimoides*
sour sob	*Oxalis pes-caprae*

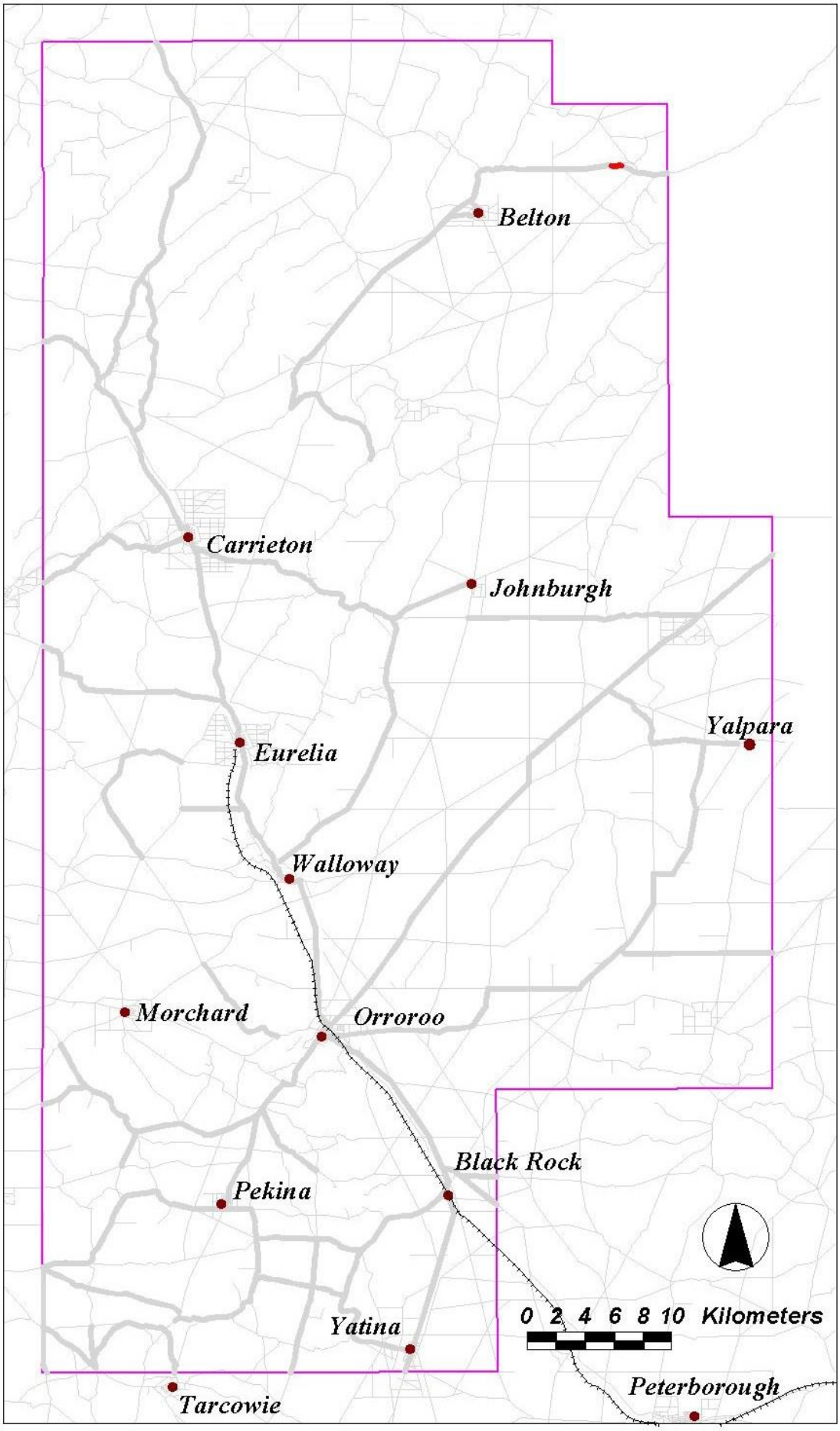
statice	*Limonium lobatum*
stinkwort	*Dittrichia graveolens*
tagasaste	*Chamaecytisus palmensis*
tall brome grass	*Bromus diandrus*
tobacco bush	*Nicotiana glauca*
vetch	*Vicia sp.*
Ward's weed	*Carrichtera annua*
wild oats	*Avena barbata*
wild sage	*Salvia verbenaca form*
wild turnip	*Brassica tournefortii*



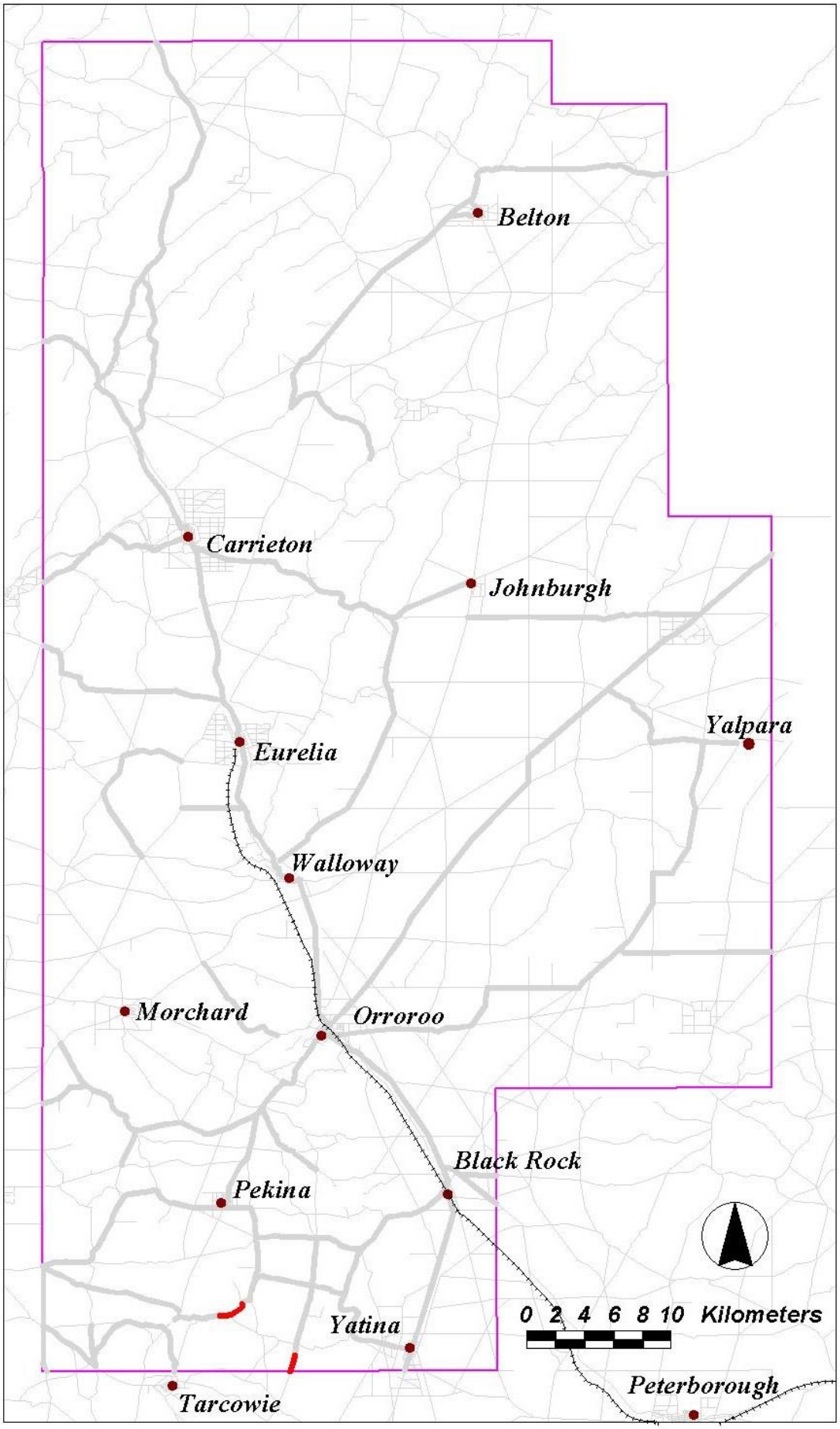
Map 7 Distribution of *Lycium ferocissimum* (African boxthorn)



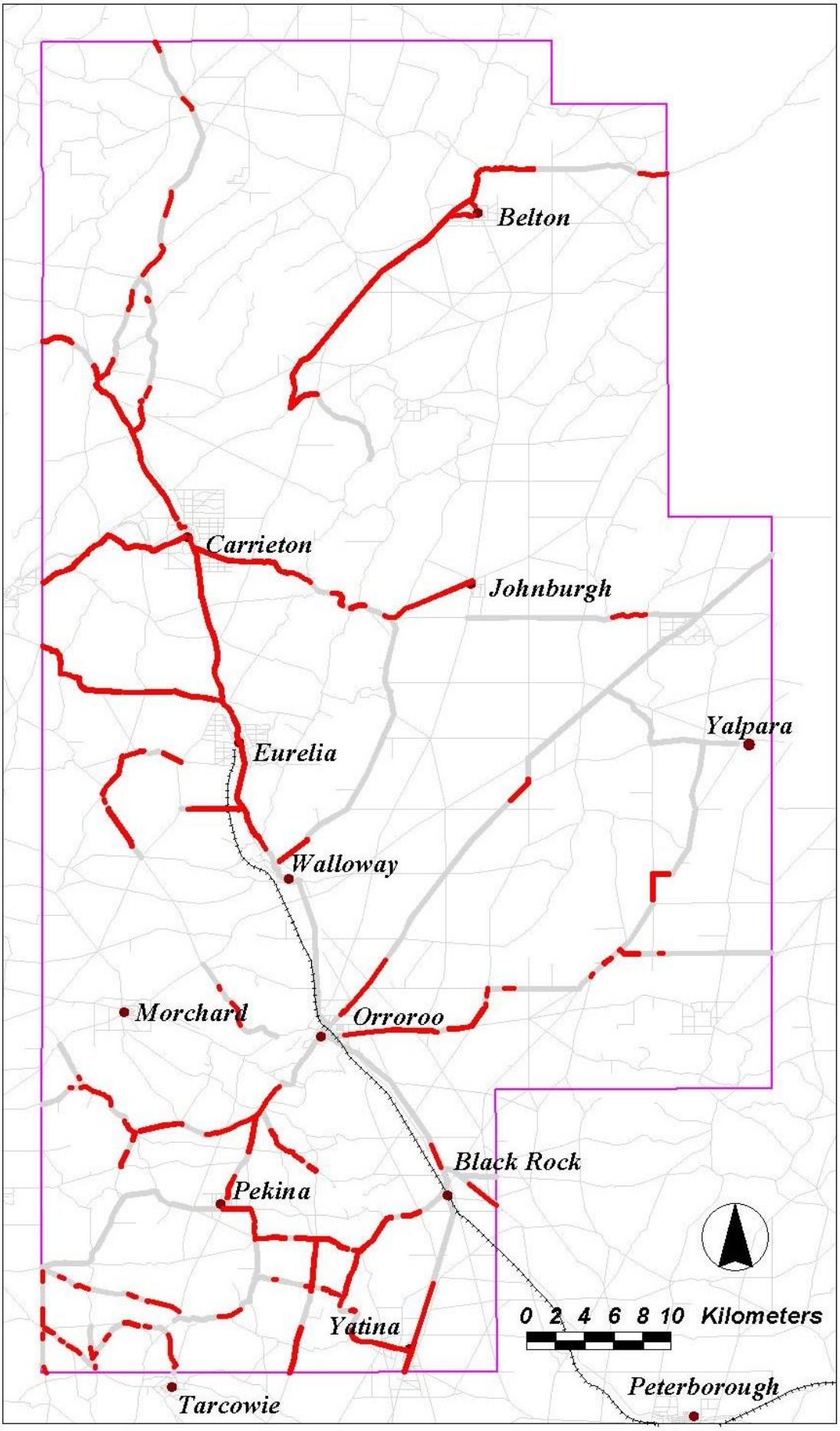
Map 8 Distribution of *Peganum harmala* (African rue)



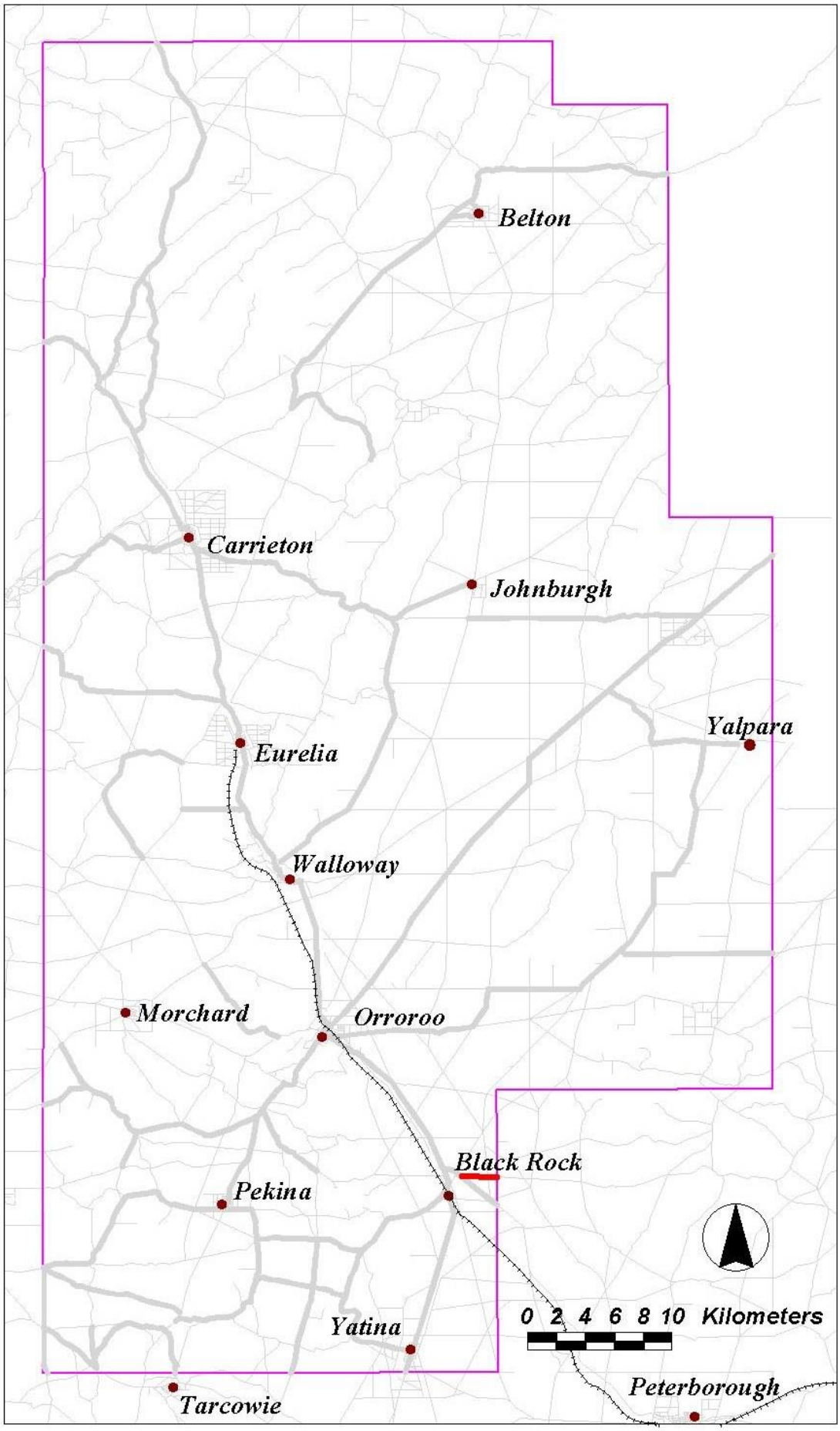
Map 9 Distribution of *Xanthium spinosum* (Bathurst burr)



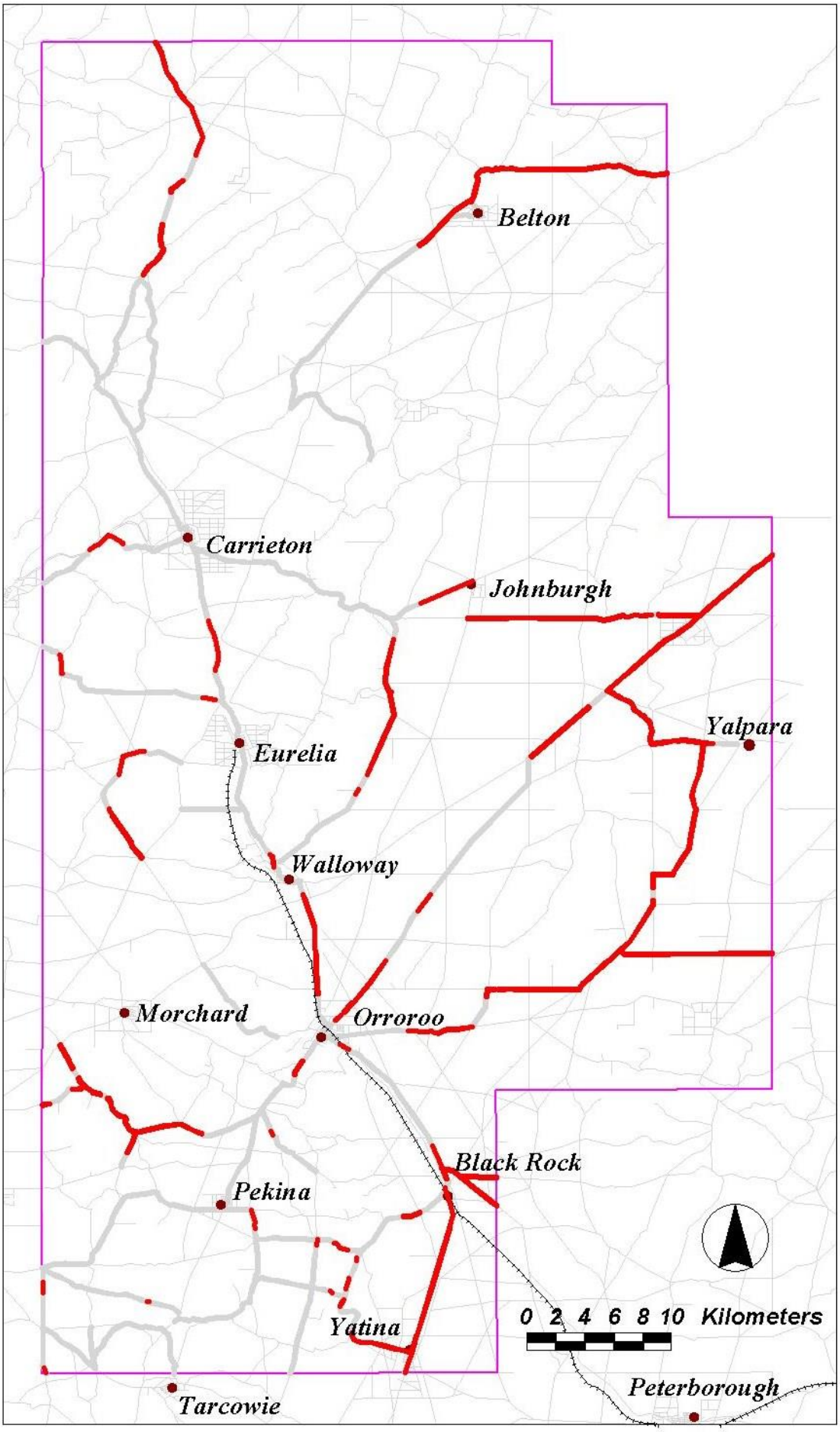
Map 10 Distribution of *Rosa canina* (Dog rose)



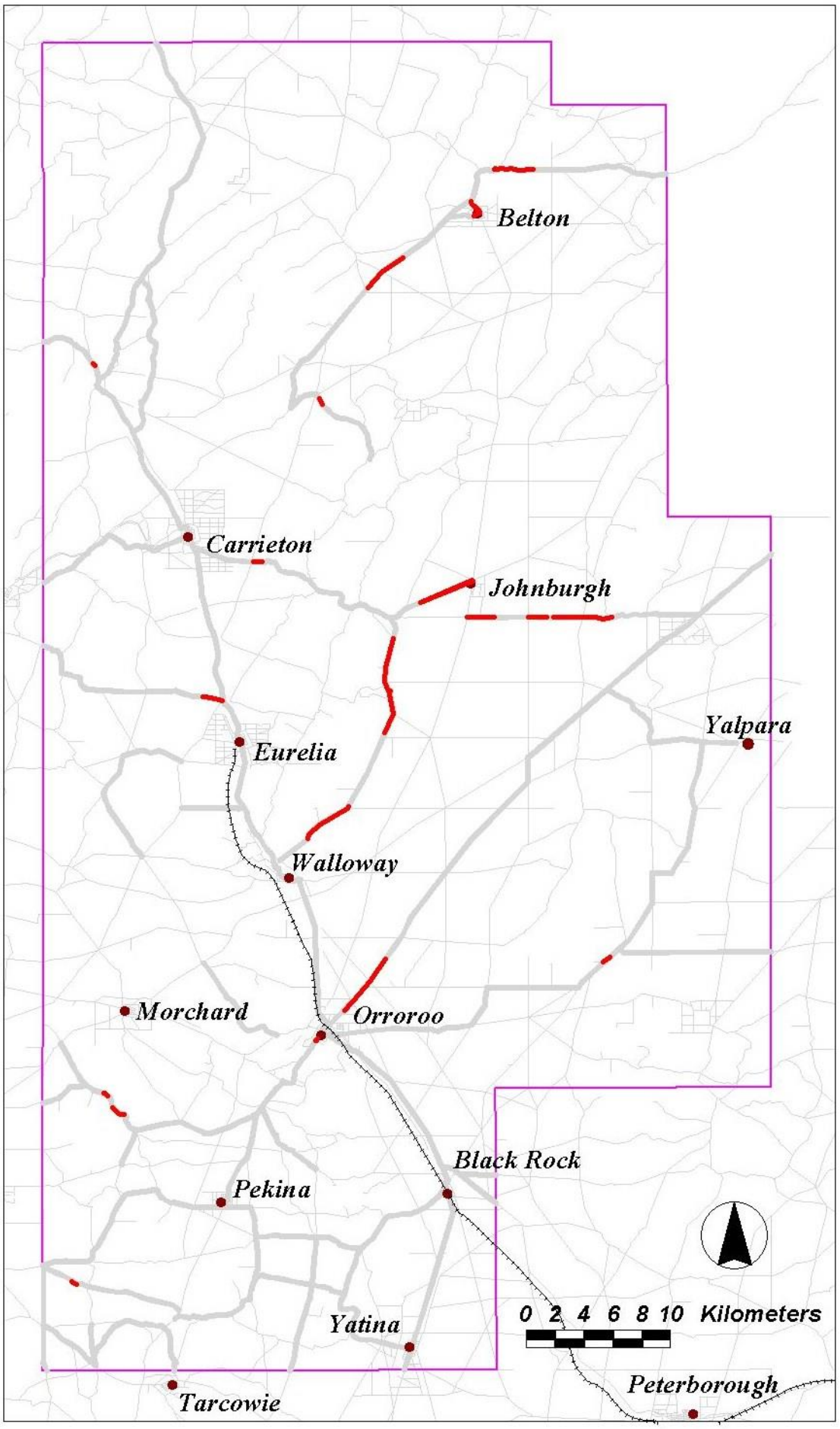
Map 11 Distribution of *Marrubium vulgare* (Horehound)



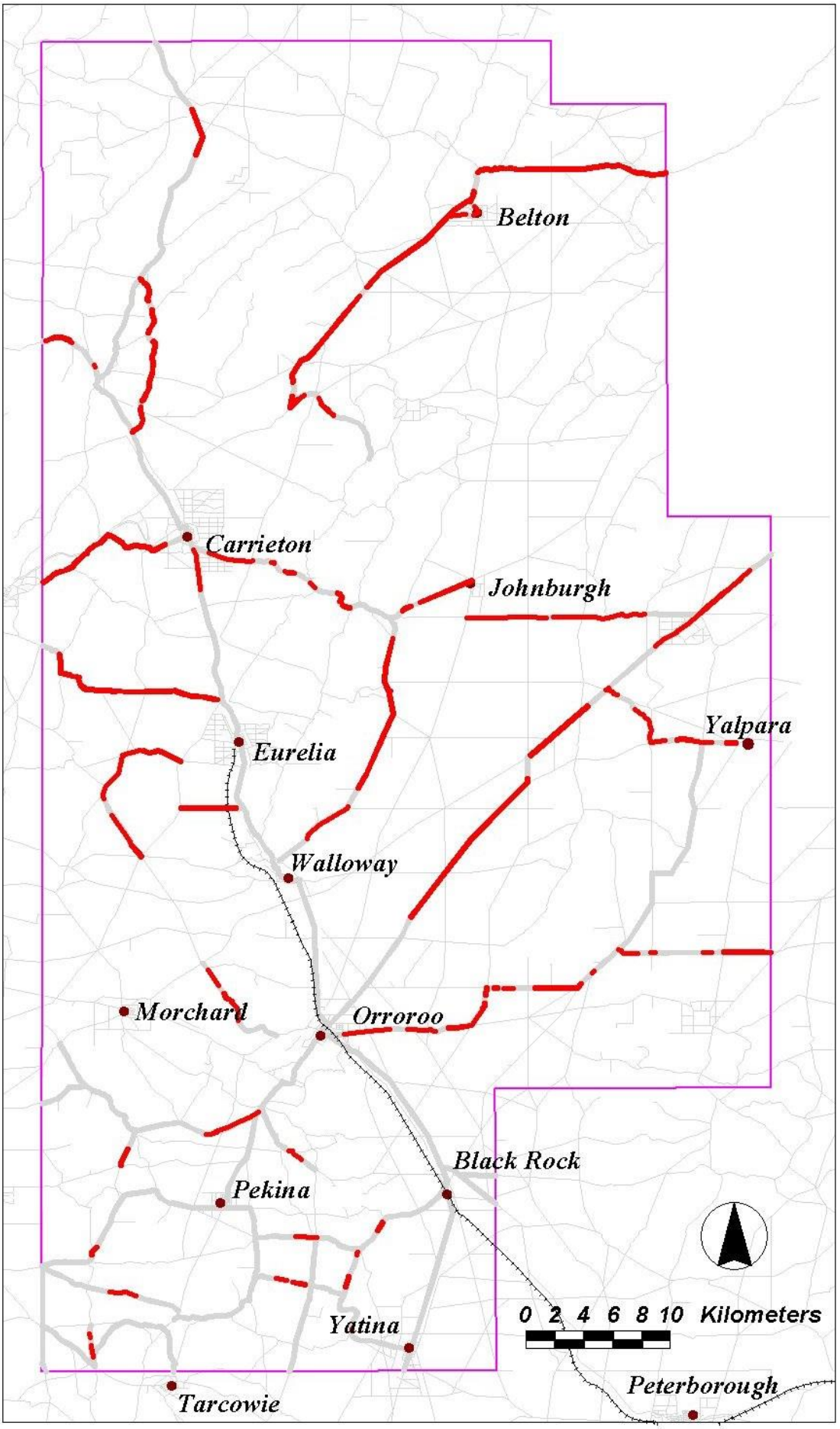
Map 12 Distribution of *Diplotaxis tenuifolia* (Lincoln weed)



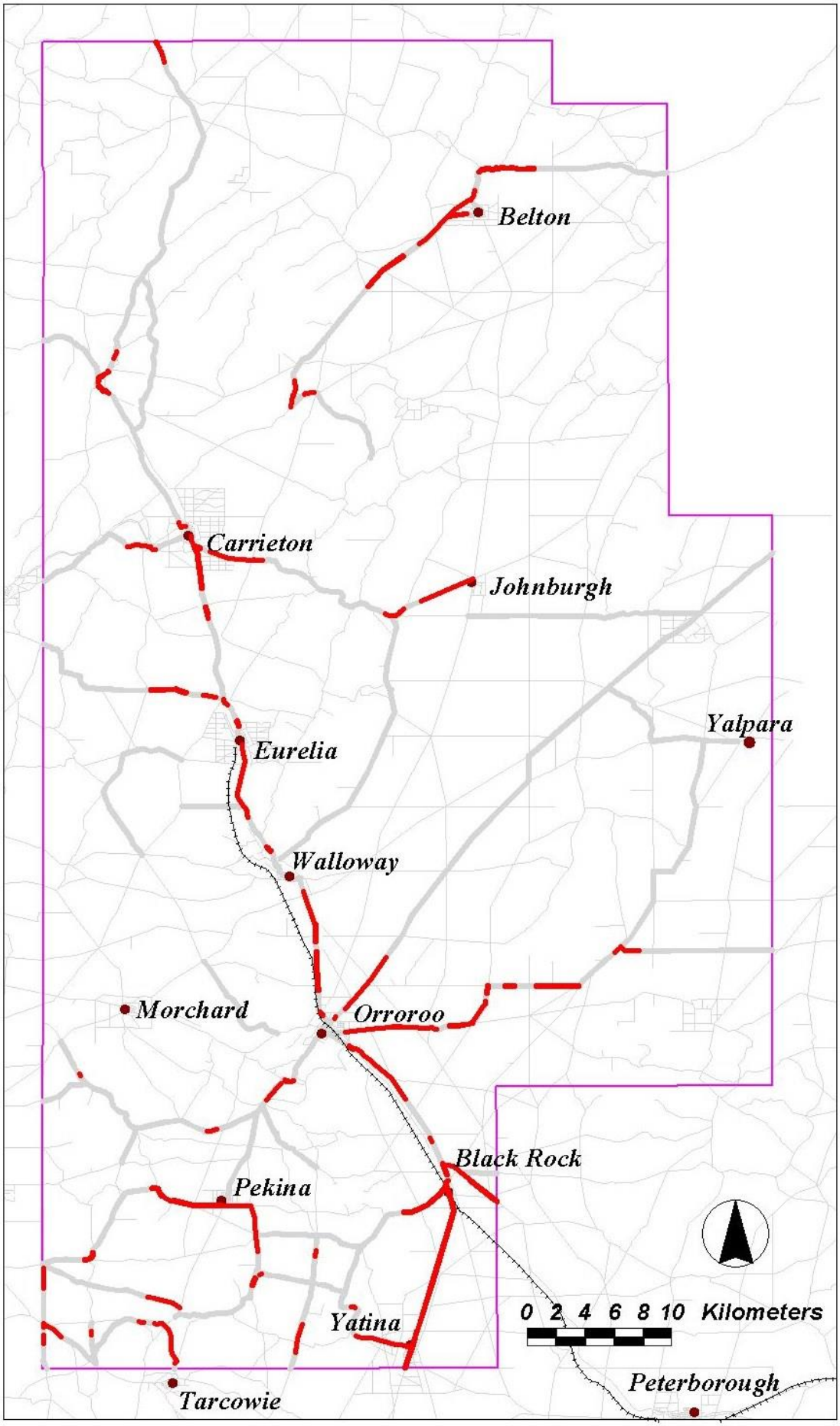
Map 13 Distribution of *Asphodelus fistulosus* (Onion weed)



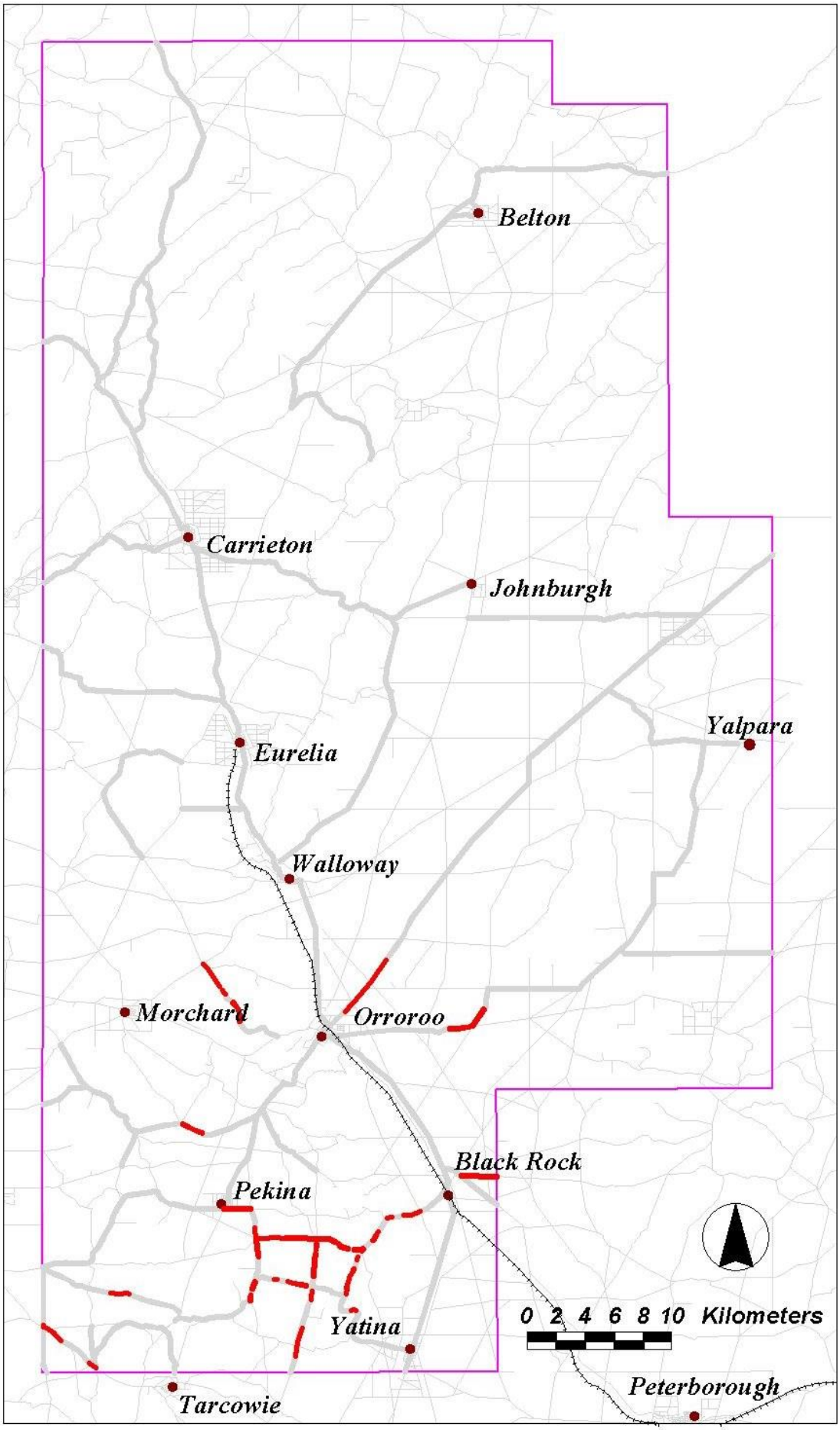
Map 14 Distribution of *Schinus areira* (Pepper tree)



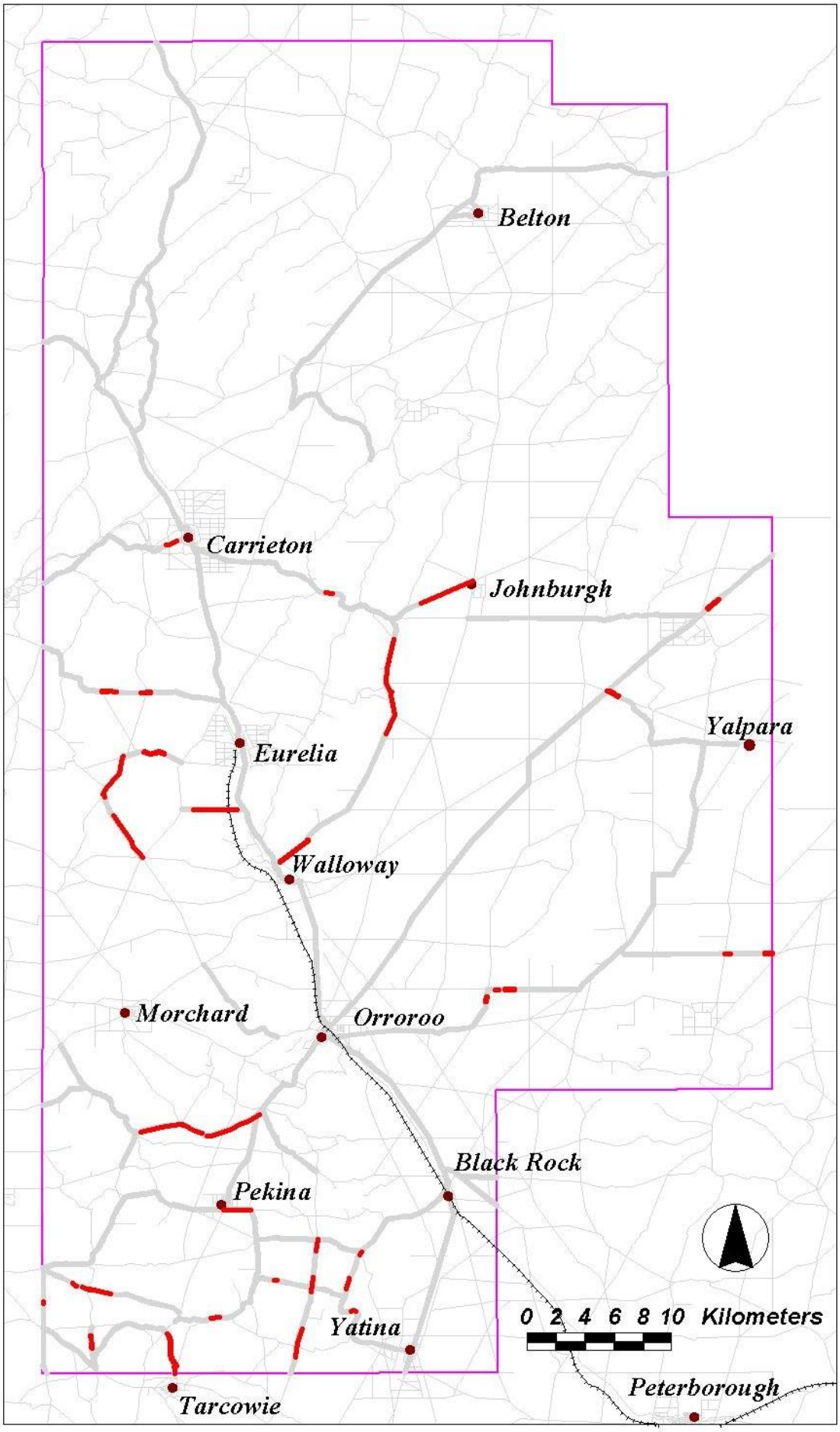
Map 15 Distribution of *Carthamus lanatus* (Saffron thistle)



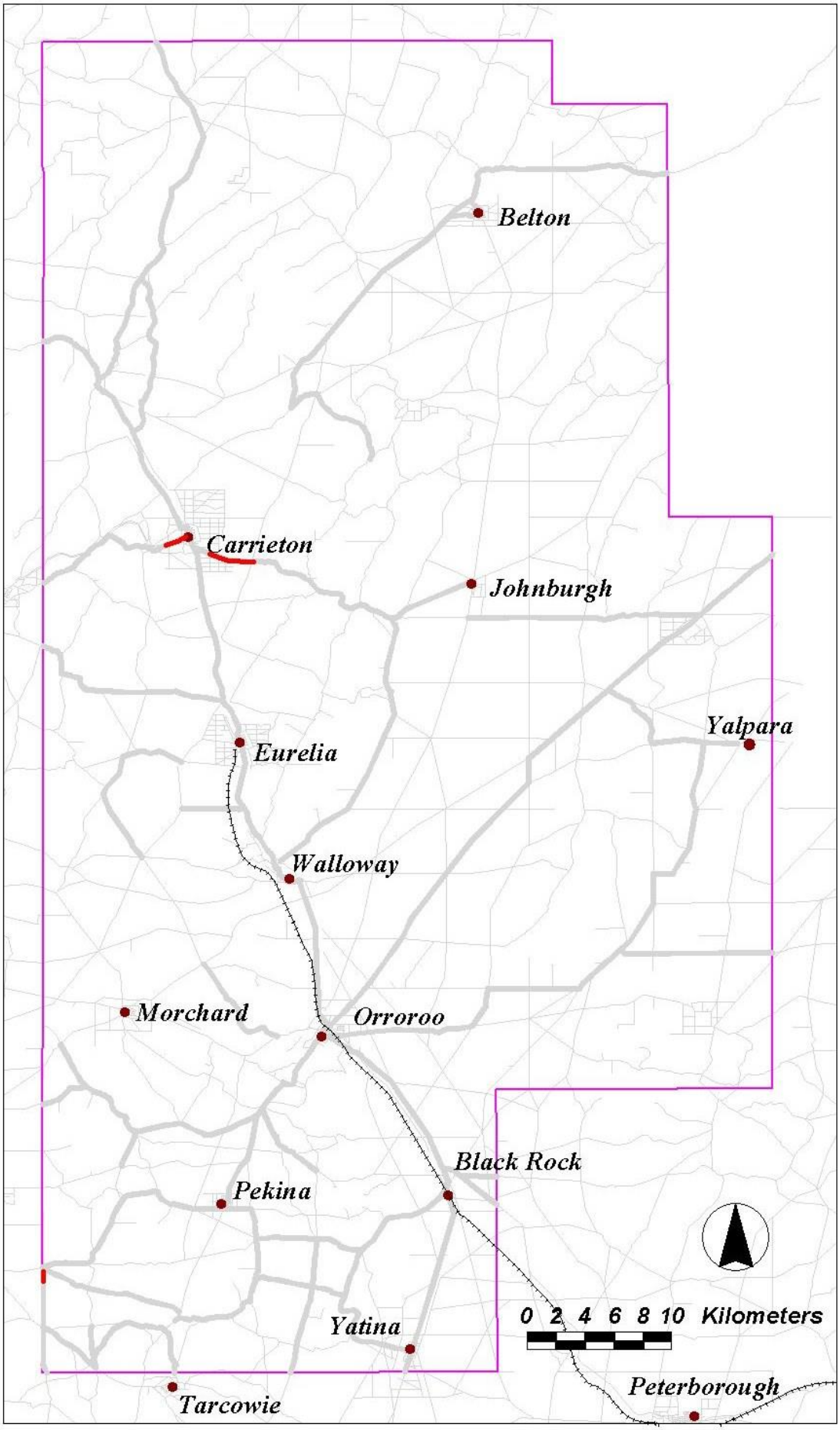
Map 16 Distribution of *Echium plantagineum* (Salvation Jane)



Map 17 Distribution of *Centaurea calcitrapa* (Star thistle)



Map 18 Distribution of *Onopordum acaulon* (Stemless thistle)



Map 19 Distribution of *Cynara cardunculus* (Wild artichoke)

5 MANAGEMENT ISSUES

5.1 GENERAL

A wide range of exotic plant species very heavily infests the majority of the roadsides in the Orroroo/Carrieton District Council area. Roadsides that can be considered to be in "good" condition are generally in the hilly areas where clearance for agriculture has been less severe and pastoral land uses more common historically. There are also quite large areas where native grasses are prominent in the roadside vegetation mix. Whilst the native grasses in these areas may not be the dominant species, they are nevertheless very important remnants of the original vegetation in the region. Pressure of urban and horticultural development in the more fertile areas has enhanced the spread of competitive exotic plants and subsequently severely depleted the biodiversity and habitat values of the surviving remnants.

Recommendations made in this report are based on the information gained from the DTEI and Orroroo/Carrieton District Council drive-by surveys. The roadside areas described and mapped as being appropriate for a range of management practices have been derived using the standard DTEI roadside survey and analysis procedures. Areas where inconspicuous significant plants occur, and areas where annual species are significant, have not been mapped or recorded unless they were obvious at the time of survey. The time of survey was not ideal for collecting native vegetation information, being in a period of extended dry weather. Locations and descriptions of areas that are known by local people to contain species of importance that may have been overlooked in the drive-by-mapping process can then be included in the list of areas for special management.

5.2 VEGETATION CLEARANCE APPPROVALS PROCESS

Minor clearance of native vegetation may be undertaken as part of many aspects of ongoing roadside management as described in Table 6 (p.46). Some of these activities may require vegetation clearance that needs approval from Native Vegetation Council. Others can be handled within Council by the Works Manager or delegated suitably qualified staff member. Others require no formal approval. Table 8 below details when NVC approval is required for a range of roadside activities.

5.2.1 MAINTENANCE

Maintenance of existing roadside vegetation clearances by low-impact methods can generally proceed without clearance approval. Clearance approval from the Native Vegetation Council is needed where clearance exceeding previously established safety standards is proposed, or regrowth has reached the stage where high-impact methods (eg. bulldozing) are proposed.

5.2.2 CONSTRUCTION

Clearance approval from the Native Vegetation Council is required for new roadworks (construction, widening, and realignment) which involve clearance of native vegetation. Note that this requirement does not apply to very minor and localised clearance, such as pruning of branches or removal of one or two tree saplings or shrubs which are known to be common in the area. However, even in these cases it is recommended that the Native Vegetation Council Secretariat be advised prior to the work. It is just possible that the site may contain a small, visually insignificant plant species (eg. orchid or native grass) which is of particular conservation significance. A telephone call to the Secretariat will enable records to be checked.

Where possible, advice on an annual basis is to be provided to the Native Vegetation and Biodiversity Management Unit regarding new roadworks planned for the forthcoming year in areas of native vegetation. This can be important as; if the matter needs to be referred to the Native Vegetation Council, delays can occur.

Activity	Assessment / approval requirement		
	None	**Internal**	**External (NVC)**
Road Maintenance (Patrol grading, drain clearing, vegetation trimming, pavement resheeting, pothole repairs, etc.)	If all work occurs within NVC approved "maintenance envelope" as defined in Transport SA's "Vegetation Removal Policy".	Minor clearance, such as: Clearing existing open drains (eg. turn-outs); vegetation control at intersections & driveways; new roadside turning or temporary storage areas for mobile plant.	Any clearance outside NVC approved "maintenance envelope". e.g. construction of new open drains; new stockpiles or work areas outside approved "maintenance envelope"; other maintenance requiring increased clearance or use of high impact methods.
Road Construction (Pavement widening, curve realignment, reconstruction & sealing, intersection modification, etc.)	If work occurs within existing road formation or previously cleared roadside areas.	Minor clearing restricted to degraded sites (e.g. for temporary stockpiles; equipment turning or temporary storage areas).	Any clearance of vegetation outside existing road formation (excluding previously assessed sites).
Pest Animal & Plant Control	If no native vegetation is present based on previous assessment.	Minor clearance based on low off-target damage risk (e.g. selective control using low impact methods) in degraded native vegetation. Rabbit baiting programs in native vegetation.	All but very minor clearance. Large control programs involving high off-target damage risk.
Fenceline clearance	If vegetation is to be removed within 1m of existing fence-line and no plants of conservation significance are likely to be affected based on previous assessment.	If vegetation is to be removed within 1m of existing fence-line where plants of conservation significance may be present.	Any clearance exceeding approved standard.
Property access	If no native vegetation is present based on previous assessment.	Maximum 5m wide (normal access), 10m wide (machinery) if native vegetation is present (but not of conservation significance).	Any clearance exceeding approved standard.

Activity	Assessment / approval requirement		
	None	**Internal**	**External (NVC)**
Fire hazard reduction	If firebreak has been ploughed in the previous year. If no native vegetation is present based on previous assessment.	If firebreak has been ploughed prior to previous year and natural regeneration may have since occurred. New breaks maximum 20 m long across roadside, not < 500m apart, on previously cleared or areas without native vegetation.	Any other proposed clearance for fire prevention.
Stock Grazing	If no native vegetation is present based on previous assessment.	No native vegetation or only mature native trees & exotic grasses present. Short-term (i.e. < 1 week)	Where native understorey or regenerating native vegetation is present.
Removal of plant material	If no native vegetation is present based on previous assessment. Firewood collection is not permitted on roadsides.	Vegetation is removed under permit from council or as per guidelines. Firewood collection is not permitted on roadsides.	Live timber, flowers, rare, NPW Act scheduled species, significant habitat. Firewood collection is not permitted on roadsides.
Maintenance of vegetation diversity	If no native vegetation is present based on previous assessment.	If trimming or pruning of vegetation using appropriate, low impact cutting tools is proposed.	Any measures involving burning, lopping or other disturbance of native vegetation.

Table 8 Vegetation Clearance Approval processes

5.3 ROADSIDE VEGETATION MANAGEMENT ACTIONS AND POLICIES

The following sections provide some background and guidance in aspects of roadside vegetation management. In general terms, any maintenance or construction activity on roadsides will be undertaken in accordance with the following "Environmental Code of Practice". The Works Manager or a suitably qualified delegate undertakes all internal decision-making regarding vegetation clearance.

To address a range of more specific roadside management issues, some more specific guidelines and policies follow.

5.3.1 ENVIRONMENTAL CODE OF PRACTICE FOR ROADSIDE VEGETATION MANAGEMENTMAINTENANCE & CONSTRUCTION WORKS

- **Protect native vegetation and natural regeneration**
- **Avoid working under tree canopy**
- **Avoid mowing – only up to back of table drain**
- **Only use herbicide when mechanical control inappropriate**
- **Spray carefully and not in windy conditions**
- **Retain stumps, dead wood and understorey where possible**
- **Locate firebreaks on cleared or private land**
- **Remove drain spoil and dispose of at a weed disposal site**
- **Locate stockpiles, turnouts etc on existing cleared land**
- **Carefully prune trees using prescribed methods**
- **Avoid damaging undergrowth when removing trees**
- **Use only appropriate type and minimum sized machinery**
- **Use only fill from weed and disease free sites**
- **Control erosion**
- **Clean machinery before entering and leaving a new work site**
- **Dispose of waste materials at an appropriate site**

CONSTRUCTION WORKS

- **Clearly mark limits of construction zone**
- **Stay within the construction zone**
- **Chip light material from tree removal and use as mulch**
- **Strip and stockpile topsoil from areas of good native vegetation and reuse as soon as possible**

COUNCIL POLICY

All maintenance and construction activities on roadsides will be undertaken with regard to the "Environmental Code of Practice" and the "Unsealed Roads Manual - Guidelines to Good Practice". Clearance envelopes for all classes of roads are in accordance with DTEI's "Vegetation Removal Policy".

5.3.2 REVEGETATION AND SITE REHABILITATION ON ROADSIDES

Emphasis should not be confined to trees but be equally given to shrubs and groundcover. The complexities of natural systems must be considered when planning roadside management. This approach will naturally have the flow-on effect of minimising damage through lerp or mistletoe infestations.

Exotic bees can compete with native bees for food and consequently upset the natural balance of the ecosystem. Predators of native bees also aid in controlling crop and pasture pests, thereby providing an economic benefit. The depletion of the native bee population through competition with introduced bees may also leave native vegetation and nearby crops with inadequate vectors for pollination when the exotic bees are removed.

Natural or managed regeneration of indigenous vegetation should be encouraged, especially where regrowth cannot occur on neighbouring land because of regular grazing or tillage. Indigenous species are usually easiest and cheapest to establish and perpetuate and maintain appropriate habitats for wildlife. They also provide local gene pools and landscape character.

Mature, senescent and standing dead trees often contain hollows and are of particular value for native animals and should be retained where possible. Fallen limbs also provide habitat for small terrestrial mammals and reptiles.

Where a new road is being constructed along a previously undeveloped road reserve, it is preferable that the carriageway be offset to one side of the reserve. Similarly, road widening should be undertaken on one side only. This enables a broad strip of vegetation to be retained on one side of the road rather than a narrow strip on each.

Where a road is to be widened, consideration should be given to purchasing a strip of adjacent cleared land to re-establish a verge as wide as (or wider than) the one that will be lost. Alternatively, negotiation with the neighbouring landowner may allow for a revegetated strip adjoining the road to be established on private land and protected through lease and covenant arrangements. Some wide, often irregular shaped roadside reserves exist in places where intersections have been redesigned or roads realigned. Many of these areas are degraded. In the process of recreation and revegetation planning by Council, consideration should be given to creating picnic areas or at least undertaking some weed control and revegetation with appropriate species, taking into account road safety considerations.

Focus for comprehensive revegetation projects should be on roadsides where reserves are wider than the normal 1 chain, of low Overall Significance and where they join areas assigned to Management Category A. These areas can often be treated with a total weed eradication procedure as part of the site preparation, because there is little chance of damaging valuable native vegetation.

Guiding principles are:

- Use a total ecosystem approach
- Do not permit apiarists to locate hives on roadsides
- Where road widening would seriously affect roadside of conservation value, consider acquiring alternative land
- Design road works to leave the widest possible verge
- Retain dead trees
- Encourage regeneration of indigenous vegetation
- Use local provenance seed and seedlings as much as possible

This information focuses on the revegetation of roadsides.

Where indigenous vegetation is the predominant vegetation type, revegetation and rehabilitation of roadsides should aim to re-establish indigenous vegetation to:

- restore visual amenity and enhance the landscape quality of the roadside
- provide the natural source of food for native animals
- restore fauna habitat and extend corridors linkages
- reduce the risk of weed introduction
- prevent erosion following construction works
- create visual interest for drivers to keep them alert
- screen headlight glare and define curves
- ensure adequate safety sight distance is maintained

COUNCIL POLICY

Undertake or support total revegetation projects in roadside verges which are wider than 6 metres, do not pose traffic hazards, and have a Management Category of E. Adhere to the guidelines and objectives listed above in all revegetation projects.

5.3.3 PEST ANIMAL AND WEED CONTROL

Roadsides are particularly vulnerable to weed invasion as they have a larger perimeter (or "edge") to area ratio. As edges are particularly prone to degradation, the greater the length of the 'edges', the greater the opportunities for degradation. The roadside edges are subject to high levels of disturbance, and the spread of weeds is encouraged by any disturbance including burning, clearing, grazing, ploughing of firebreaks, and service installation.

Clearance approval is required from the Native Vegetation Council where a proposed animal or plant control program is likely to cause significant damage to native roadside vegetation. "Significant" in this context includes ripping of warrens where native vegetation will be affected, non-selective spraying in mixed weeds/native vegetation, and burning of native vegetation to assist pest control. It does not include minor damage, such as removal of branches to gain access to pests.

The NVC Secretariat is able to approve clearance of a "non-sensitive" nature, and will determine whether the proposed clearance is of a sufficiently significant nature to warrant referral on to the Native Vegetation Council for decision.

Routine maintenance and construction activities can contribute to the degradation of native vegetation and the spread of weeds through:

Grading
During grading, shoulder material and topsoil can be spread along the road reserve and into areas of remnant vegetation. This material often contains weed seeds and the activity can create a disturbed environment for the introduced seeds to successfully invade. Risk can be minimised by:

- Avoiding disturbance to remnant vegetation,
- Avoiding grading from weed infested areas into areas of remnant vegetation,
- Avoiding grading if species that spread vegetatively are present (eg. African rue, onion weed),
- Grading at sufficient depth to prevent regrowth from plants,
- Cleaning equipment regularly, and
- Following up grading to achieve better results, eg. spraying seedlings that emerge after grading.

Herbicide spraying
Off-target spraying may kill native understorey and create an altered environment for weeds to invade. Risk can be minimised by:

- restricting spraying to the road shoulder and around road furniture,
- not spraying on wet or windy days,
- not using residual herbicides along watercourses, and
- not using non-selective herbicides near susceptible plants.

Vegetation Removal
Vegetation removal can damage soil structure and understorey vegetation. Risk can be minimised by:

- Avoiding disturbance to the understorey and soil during removal (i.e. fell trees into the construction zone, leave stumps in the ground and keep plant equipment out of the road reserve),
- Returning mulched vegetation and topsoil to the area it came from,
- Revegetating with appropriate species as soon as practical after removal,
- Only removing native vegetation when absolutely necessary, and
- Limiting topsoil movement along the road reserve.

Parking machinery and stockpiling material
Parking machinery and stockpiling material along a construction site leads to the movement of large quantities of soil and associated weed seeds around the site. Risk can be minimised by:

- Choosing appropriate locations, i.e. away from native vegetation and in already cleared areas,
- Controlling weeds in parking and stockpile areas,
- Restricting vehicle movement and parking to the construction footprint, and
- Cleaning plant and equipment regularly.

Importing fill
Importing fill often leads to the introduction of new weed species into an area. Risk can be minimised by:

- Ensuring that (as much as possible) fill is clean and free of weed seeds,
- Spraying stockpiled material if weeds emerge,
- Obtaining fill from nearby sources,
- Minimising disturbance around borrow pits where the fill material is being excavated.

5.3.3.1 APPROACHES TO WEED MANAGEMENT

The process of biological invasion by weeds begins with their **introduction**, then their **establishment and local colonisation**, **survival**, **reproduction**, and **widespread dispersal**, eventually finishing with **full colonisation of their potential range**. Intervention in this process at an early stage is far more effective than if a weed has become well-established and is in the dispersal or full colonisation phase (NWS 1999).

Weeds can be managed using many different methods. The most effective management of weeds is usually achieved by a combination of methods with follow-up over a number of years. The stage that a weed has reached in the invasion process determines the best approach for its control.

The three main approaches to weed management are:

- Prevention of establishment,
- Early detection and eradication, and
- Management of existing populations.

Prevention
This is the most effective means of control. Establishing workable prevention mechanisms is much more cost-effective than controlling established populations.

Prevention mechanisms include:

- cleaning machinery between jobs,
- only using clean, weed-free fill materials, including stockpiles,
- marking turn-around points for maintenance works to prevent longitudinal spread through mowing or grading,
- mulching or revegetating disturbed areas, and
- minimising or avoiding disturbance in areas of native vegetation.

Early Detection and Eradication
The second most cost-effective means of weed control is early detection and eradication. Eradication of newly established populations is possible only if detection mechanisms are in place to identify them.

Management of Existing Populations
Managing existing weed infestations can involve eradication, control or containment depending upon the extent and severity of infestations, and the resources available to manage the program. Mulching, burning, cultivation, introduction of competition, grazing, biological control and chemicals are all management tools that can be used where appropriate.

COUNCIL POLICY

Contract local NRM Board to control proclaimed pest plants on roadsides working within minimum disturbance guidelines where native vegetation is present. Ensure that adjacent landholders adhere to minimum disturbance guidelines when controlling pest animals in roadsides for which they are responsible, where native vegetation is present, and that they first contact the local NRM Authorised Officer as a first point of contact for advice.

5.3.4 GRAZING AND STOCK MOVEMENT

Grazing of domestic livestock is defined as vegetation clearance under the Native Vegetation Act, 1991. Movement of stock along road reserves can aid the spread of weeds, compact the soil, exacerbate soil erosion problems and hinder native plant regeneration. Whilst it is necessary to allow the droving of stock along road reserves to move them between paddocks, droving should be avoided where native vegetation in management category A or B may be damaged. Alternative routes for stock movement should be sought through negotiation with the relevant landholders.

COUNCIL POLICY

Grazing of stock along roadsides is not allowed. When stock movement is necessary, routes containing significant vegetation sites will be avoided and stock kept moving at a reasonable pace at all times.

5.3.5 FENCING

A landholder who wishes to clear native vegetation on a road reserve, to enable construction or maintenance of a boundary fence, requires local council approval, and must comply with the following guidelines:

- Where the roadside vegetation consists largely of trees, only branches protruding through or overhanging the fence, or trees growing on the actual fence alignment, should be removed.
- Where shrubs or bushes are growing through the fenceline, those plants growing within one metre of the fence alignment can be removed.
- Where any such clearance is undertaken and the adjacent roadside vegetation is management category A or B or contains a roadside significant site, minimal disturbance techniques should be employed and clearance restricted to trimming overhanging limbs or trees on the fence line.

Clearance approval from the Native Vegetation Council is required for any vegetation clearance along fencelines which exceeds the above standards.

COUNCIL POLICY

Fenceline clearance applications are assessed individually, and in areas of native vegetation, minimal disturbance techniques should be employed and clearance restricted to trimming overhanging limbs or trees on the fence line.

5.3.6 MARKING OF ROADSIDE SIGNIFICANT SITES

A process for systematically marking roadside sites supporting significant native vegetation has been developed by the Roadside Marker System Steering Group with members representing Local Councils, Department for Environment and Heritage (DEH), Department of Transport, Energy and Infrastructure (DTEI) and two conservation groups.

The Roadside Marker System (RMS) has been designed to identify sites of natural, historic and cultural significance so that these important sites can be avoided and protected during roadwork and other public utility work nearby. In particular, Councils are adopting the RMS to manage roadside native vegetation. The system is voluntary, and uses a simple uniform standard for marking sites. This assists Council to protect remnant native stands, and to comply with the requirements of Commonwealth and State conservation, heritage, soil and landcare legislation. On those Transport SA roads previously surveyed, some sites are already marked. Their locations and reason for marking are listed in Appendix C. Those areas, which have been identified as Overall Significance (Management Category) A or B, should be maintained or enhanced where possible in accordance with the recommendations of this plan. This requires that the field staff, contractors, and works managers be aware of the precise locations of these sensitive roadside areas. Precise locations will need to be ascertained in the field, because the survey was conducted only to an accuracy of approximately 50 metres.

COUNCIL POLICY

Mark all areas designated in Management Category A or B or known to contain threatened species using the standard Statewide "Roadside Marker System". Maintain and update as required a database of all roadside significant sites. In marked areas, management actions as detailed in Table 6 will be adhered to.

5.3.7 REMOVAL OF PLANT MATERIAL

Dead timber on roadsides can provide valuable habitat for small mammals, reptiles and most importantly invertebrates. Allowing it to decompose through natural processes also maintains integrity of the nutrient cycling that underpins stable ecosystems. Removal of dead timber destroys these habitats and processes. Another aspect of the stability of roadside ecosystems is the maintenance of the ability to regenerate. Excessive removal of seed from native vegetation diminishes the amount of seed available in the soil for new plants to grow from. Ultimately, this can lead to lower densities of some species and alteration of the vegetation structure.

COUNCIL POLICY

Removal of dead timber from roadsides is not permitted.

Seed collection from native vegetation remnants is allowed by permit only. Permits are obtained by application to Council, and are also required from DEH under the National Parks and Wildlife Act. Activities involving live timber harvesting or brush cutting are subject to the provisions of the Native Vegetation Act and the approval of the Native Vegetation Council.

5.3.8 BUSHFIRE HAZARD REDUCTION

Section 41 of the *Country Fires Act 1989* requires that:

"A rural council that has the care, control or management of land in the country must take reasonable steps to protect property on the land from fire and to prevent or inhibit the outbreak of fire on the land, or the spread of fire through the land and must take into account proper land management principles".

The DCOC does not currently undertake vegetation clearance for bushfire hazard reduction as the risk of bushfire in the region is considered to be low.

Formal NVC approval for vegetation clearance will be required when any new fuel reduction works involve clearance of roadside native vegetation, where the proposed clearance is inconsistent with the rems of the Native Vegetation Regulations – Exemption 5(1)(x).

In light of recent (2009) changes to Native Vegetation Act Regulations regarding bushfire, this section will be updated when NVC has incorporated those changes into guidelines for 'Bushfire Hazard Reduction on Roadsides'. Suggest delegate back to Secretariat for wording for this Section.

6 TRAINING AND EDUCATION

In order for Council's policies regarding native vegetation within road reserves to be upheld, anyone conducting work or activities within road reserves must be familiar with the guidelines within this RVMP.

Workshops will be conducted for Council staff that work on roads and within road reserves explaining this RVMP and its use. The workshops are to be held bi-annually and may be conducted by the Manager of Engineering Services or alternatively, an accredited environmental training organisation.

Any new staff will be familiarised with this RVMP as part of the normal employee induction procedure. Similarly all staff will be made aware of any updates as they are incorporated into the Plan.

Some staff may not be familiar with the local native plants and weed species, which may affect appropriate management practices. Council may engage an accredited native vegetation organisation to provide environmental training in this area should the need be identified. The NVC has made a recommendation that Anne Brown (Greening Australia) could be engaged for this purpose.

Significant roadside vegetation (Management Category A and B) is incorporated into a 'Significant Sites Register' and signed with Roadside Vegetation Markers. The relevant information in this register will be made available to landholders whose property adjoins these significant sites.

LIST OF POTENTIAL TRAINING ORGANISATIONS:

Business SA – 'Environmental Awareness Training for Road Maintenance Workers'

Civil Train – 'Environmental Awareness Training'

Greening Australia – 'Conservation and Land Management Training'

Transport SA (DTEI) – 'Environmental Awareness for Civil Construction Projects'

7 REPORTING AND REVIEW

It is a requirement of the NVC that an annual report on the RVMP is undertaken to demonstrate that the Plan is being used and adhered to. The report is to be used by Council to evaluate the implementation and compliance with the RVMP in three ways:

- as an internal check on compliance
- as the annual report to the NVC
- as a basis for reporting on the RVMP in Council's annual report

A standard template for the annual reporting process is included in Appendix G.

The NVC requires that RVMPs are reviewed initially after three years from commencement of the Plan and then at five-year intervals. The Manager of Engineering Services (Mr John Schmidt) will be responsible for the review and any revision of the RVMP.

8 CONTACT DETAILS

- Native Vegetation Council & Native Vegetation Council Secretariat - Ph: 8303 9741, Fax: 8303 9780, Email: nvc@sa.gov.au, and Web address: www.dwlbc.sa.gov.au/native/index.html
- Native Vegetation and Biodiversity Management Unit, GPO Box 2834, ADELAIDE SA 5001, Ph: 8303 9777, Fax: 8303 9780

REFERENCES AND FURTHER READING

Crawford, C. (1994). Remnant Vegetation of Roadsides and Reserves of the District Council of Stirling. Stirling Council, Adelaide.

CSIRO (undated). Insect Pests of Eucalypts - Identification leaflet 9. CSIRO Publishing, Collingwood, Victoria.

CSIRO (undated). Insect Pests of Eucalypts - Identification leaflet 12. CSIRO Publishing, Collingwood, Victoria.

Davies, R. J-P. (1982). The Conservation of Major Plant Associations in South Australia. Conservation Council of South Australia, Adelaide.

Donato, D. (1991). Murray Mallee Roadside Vegetation Management Plan. Murray Mallee Roadside Vegetation Steering Group and District Councils of Lameroo, Peake, Pinnaroo, Karoonda -East Murray and Browns Well, South Australia.

Environment Australia (1999). *Phytophthora cinnamomi* Threat Abatement Plan. Natural Heritage Trust

Department of the Environment and Heritage, Canberra.

Hyde, M. K. (1997). A Survey of the Remnant Roadside Vegetation on the Fleurieu Peninsula, South Australia - Volume 1 Yankalilla, Victor Harbour and Port Elliot/Goolwa. Wallowa Mallee Research Books, Adelaide.

Hyde, M. K. (1998). A Survey of the Remnant Roadside Vegetation on the Fleurieu Peninsula, South Australia - Volume 2 Strathalbyn. Wallowa Mallee Research Books, Adelaide.

Hyde, M. K., Zanker, D. and Lewis, S. A. (1996). Roadside Vegetation Management Plan for the Mannum and Murray Bridge Districts, South Australia, Rural City of Murray Bridge.

Jessup, R. W. (1948). "A Vegetation and Pasture Survey of Counties Eyre, Burra and Kimberley, South Australia." Trans. Roy. Soc. S. A **72**(1): 33-68.

Laut, P., Heyligers, P. C., Keig, G., Loffler, E., Margules, C., Scott, R. M. and Sullivan, M. E. (1977). Environments of South Australia. CSIRO, Canberra.

Neagle, N. (1995). An Update of the Conservation Status of the Major Plant Associations of South Australia. Department of Environment & Natural Resources, Adelaide.

Northcote, K. H. with Beckmann G.G, Bettenay E., Churchward H. M., van Dijk D. C., Dimmock G. M., Hubble G. D., Isbell R. F., McArthur W. M., Murtha G. G., Nicolls K. D., Paton T. R., Thompson C. H., Webb A. A. and Wright M. J. (1960-68): 'Atlas of Australian Soils, Sheets 1 to 10, with explanatory data'. CSIRO and Melbourne University Press: Melbourne.

Palmer, D. and Lewis, S. (1987). Mapping of Roadside Vegetation in South Australia,

Extract No.3 : Mid North and Yorke Peninsula. Department of Environment and Planning, South Australia, Adelaide.

Pedler, J. and Matheson, W. A. (1993). Roadside Management Plan for the Mallala District. Mallala Council, Adelaide.

Playfair, R. M. (1998). Mount Pleasant Roadside Vegetation Management. Resource Monitoring and Planning Pty Ltd, Adelaide.

Playfair, R. M. (2000). Barossa Council Roadside Vegetation Management Report. Resource Monitoring and Planning Pty Ltd, Adelaide.

Robertson, M. (1994). Stop Bushland Weeds. Nature Conservation Society of South Australia, Adelaide.

Specht, R. L. (1972). The Vegetation of South Australia. Government Printer, Adelaide.

Stephens, C. G., Herriot, R. I., Downes, R. G., Langford-Smith, T. and Acock, A. M. (1945). "A Soil, Land Use and Erosion Survey of Part of County Victoria, South Australia, including the Hundreds of Belalie, Whyte, Renolds and Anne, part of the Hundreds of Caltowie, Yangya and Bundaleer." Bull. Counc. Sci Ind. Res **188**.

Stokes, A. L., Heard, L. M. B., Carruthers, S. and Reynolds, T. (1999). Draft Guide to the Roadside Vegetation Survey Methodology for South Australia. Dept of Transport, Urban Planning and the Arts, Adelaide,.

Telfer, W (2001) Northern Areas Council Roadside Vegetation Management Plan. Northern Areas Council

Wigan, A. and Malcolm, I. (1989). Roadside Management Plan for Yorke Peninsula. Roadside Vegetation Steering Group, Adelaide.

APPENDIX A - CONSERVATION RATINGS FOR PLANT SPECIES

These ratings are from the unpublished database updated January 2001 by P.J. Lang, Biodiversity Branch, Department for Environment and Heritage.

AUS Conservation Rating for Australia
SA Conservation Rating for South Australia
EA Conservation Rating for the Eastern Botanical Region

X - Extinct	presumed extinct or not recorded for 50 years
E - Endangered	rare and in danger of becoming extinct in the wild.
V - Vulnerable	rare and at risk from potential threats or long-term threats which could cause the species to become endangered in the future.
T - Threatened	likely to be either endangered or vulnerable but insufficient data for a more precise assessment.
R - Rare	having a low overall frequency of occurrence: confined to a restricted range or scattered sparsely over a wider area. Not currently exposed to significant threats but warranting monitoring and protective measures to prevent reduction of populations.
K - Uncertain	likely to be either threatened or rare but insufficient data for a more precise assessment.
U - Uncommon	less common species of interest but not rare enough to warrant special protective measures.

Family	Name	Common Name	AUS	SA	EA
GYROSTEMONACEAE	*Codonocarpus pyramidalis*	slender bell-fruit	V	E	E
LEGUMINOSAE	*Cullen parvum*	small scurf-pea	E	V	V
OROBANCHACEAE	*Orobanche cernua* var. *australiana*	Australian broomrape		V	V
SANTALACEAE	*Santalum spicatum*	sandalwood		V	T
LEGUMINOSAE	*Swainsona procumbens*	Broughton pea		V	T
LEGUMINOSAE	*Acacia barattensis*	Baratta wattle		R	R
RUTACEAE	*Correa glabra*	rock correa			R
LEGUMINOSAE	*Daviesia genistifolia*	broom bitter-pea			R
LEGUMINOSAE	*Eutaxia microphylla* var. *microphylla*	common eutaxia			R
STERCULIACEAE	*Gilesia biniflora*	western tar-vine		R	R
STYLIDIACEAE	*Levenhookia dubia*	hairy stylewort			R
LEGUMINOSAE	*Acacia argyrophylla*	silver mulga-bush			K
GRAMINEAE	*Bothriochloa macra*	red-leg grass		V	K
COMPOSITAE	*Brachycome eriogona*			R	K
CYPERACEAE	*Cyperus gilesii*	Giles' flat-sedge			K
CYPERACEAE	*Cyperus nervulosus*			R	K
LEGUMINOSAE	*Daviesia ulicifolia* ssp. *aridicola*	gorse bitter-pea			K
LILIACEAE	*Dianella porracea*	pale flax-lily		V	K
LEGUMINOSAE	*Eutaxia microphylla* var. *microphylla*	common eutaxia			K
FRANKENIACEAE	*Frankenia cupularis*			R	K
COMPOSITAE	*Haeckeria punctulata*	sticky haeckeria		R	K
CHENOPODIACEAE	*Malacocera gracilis*	slender soft-horns		V	K
OPHIOGLOSSACEAE	*Ophioglossum polyphyllum*	large adder's-tongue		R	K
COMPOSITAE	*Picris angustifolia* ssp. *angustifolia*	coast picris			K
ORCHIDACEAE	*Pterostylis \Mt Victoria Uranium Mine\ (R.Bates 16740)*	Mt Victoria greenhood		V	K
ORCHIDACEAE	*Pterostylis \Oraton Rock* (R.Bates 16756)	Oraton Rock greenhood		V	K
RANUNCULACEAE	*Ranunculus pumilio* var. *politus*	smooth-fruit ferny buttercup		V	K
RANUNCULACEAE	*Ranunculus sessiliflorus* var. *sessiliflorus*	annual buttercup			K
EUPHORBIACEAE	*Sauropus ramosissimus*			V	K
GRAMINEAE	*Austrostipa tuckeri*	Tucker's spear-grass		R	K
LEGUMINOSAE	*Swainsona affinis*	small-leaf Swainson-pea			K
EUPHORBIACEAE	*Phyllanthus saxosus*	rock spurge			U

APPENDIX B - PROCLAIMED PLANTS

Proclaimed plants under the *Animal and Plant Control (Agricultural and other Purposes) Act, 1986*

Plants are classified in the following sections of the Act:

- Section 52(1) Prohibits movement of proclaimed plants into a control area.
- Section 52(2) Prohibits transport of proclaimed plants on a public road within a control area.
- Section 54(1) Prohibits on sale of plants carrying proclaimed plants.
- Section 54(2) Prohibits sale of contaminated produce, etc. carrying proclaimed plants.
- Section 56(1) Notification of presence of proclaimed plants to the Board.
- Section 56(2) Notification of presence of proclaimed plants from the Board to the Commission.
- Section 57(1) Owner of land to destroy proclaimed plants.
- Section 57(2) Owner of land to control proclaimed plants.

Plants in bold are those known to occur in the Orroroo/Carrieton District

Common Name	Botanical Name	Sections of the Act							
		52(1)	52(2)	54(1)	54(2)	56(1)	56(2)	57(1)	57(2)
African boxthorn	***Lycium ferocissimum***		o						o
African feathergrass	*Pennisetum macrourum*		o						o
African lovegrass	*Eragrostis curvula*		o						o
African rue	***Peganum harmala***		o						o
Alkali sida	*Malvella leprosa*	o	o			o	o	o	
Aleppo pine	***Pinus halepensis***								o*
Azzarola	*Crataegus sinaica*		o						
Bathurst burr	***Xanthium spinosum***		o						o
Bifora	*Bifora testiculata*	o	o						
Blackberry	*Rubus fruticosus sp. agg.*	o	o						o
Bladder campion	*Silene vulgaris*		o						o
Boneseed	*Chrysanthemoides monilifera*		o						o
Bridal creeper	*Myrsiphyllum spp.*		o						o
Broomrape	*Orobanche spp.*	o	o	o	o	o	o	o	
Buchan weed	*Hirschfeldia incana*								
Bulbil watsonia	*Watsonia meriana var. bulbillifera*		o						o
Calomba daisy	*Pentzia suffruticosa*		o						o
Caltrop	*Tribulus terrestris*		o						o
Cape broom	*Genista monspessulana*		o						o
Cape tulip	*Moraea spp.*		o						o
Carrot	*Daucus carota*								
Chilean dodder	*Cuscuta suaveolens*	o	o	o	o	o	o		o
Creeping knapweed	*Acroptilon repens*		o			o			o
Cutleaf mignonette	***Reseda lutea***		o						o
Dog rose	***Rosa canina***		o						o
English/Scotch broom	*Cytisus scoparius*		o						o
False caper	*Euphorbia terracina*		o						o
Field bindweed	*Convolvulus arvensis*		o					o	
Field garlic	*Allium vineale*		o						o
Galvanised burr	*Sclerolaena birchii*					o	o		
Golden dodder	*Cuscuta campestris*	o	o	o	o			o	
Gorse/Furze	*Ulex europaeus*		o						o
Hoary cress	*Cardaria draba*		o			o			o
Horehound	***Marrubium vulgare***		o						o
Horsetail	*Equisetum spp.*	o	o			o	o	o	
Innocent weed	*Cenchrus incertus or C. longispinus*		o						o
Khaki weed	*Alternanthera pungens*	o	o			o	o	o	
Kochia	*Kochia scoparia (not including the variety trichophylla)*	o	o						
Large seeded dodder	*Cuscuta indecorum*	o	o	o	o	o	o	o	

Common Name	Botanical Name	Sections of the Act							
		52(1)	52(2)	54(1)	54(2)	56(1)	56(2)	57(1)	57(2)
Lincoln weed	***Diplotaxis tenuifolia***		o						o
May	*Crataegus monogyna*								o
Mesquite	*Prosopis* spp.	o	o			o		o	
Noogoora burr	***Xanthium occidentale***	o	o			o		o	o
Nutgrass	*Cyperus rotundus*								
Olive	*Olea europaea*								o
Onion weed	***Asphodelus fistulosus***								o
Parkinsonia	*Parkinsonia aculeata*	o	o			o		o	
Parthenium weed	*Parthenium hysterophorus*	o	o			o	o	o	
Perennial ragweed	*Ambrosia* spp.		o						o
Perennial thistle	*Cirsium arvense*	o	o			o	o	o	
Pheasant's eye	*Adonis microcarpa*	o							
Poison ivy	*Toxicodendron radicans*							o	
Prickly pear	***Opuntia* spp.**	o	o						o
Ragwort	*Senecio jacobaea*	o	o			o	o	o	
Rampion mignonette	*Reseda phyteuma*	o	o			o	o	o	
Red dodder	*Cuscuta planiflora*	o	o	o	o	o	o		o
Rhus tree	*Toxicodendron succedaneum*							o	
Salvation Jane	***Echium plantagineum***		o						o
Serrated tussock	*Nassella trichotoma*	o	o			o	o	o	
Silverleaf nightshade	*Solanum elaeagnifolium*		o			o			o
Skeleton weed	*Chondrilla juncea*		o						o
Slender thistle	*Carduus tenuiflorus*		o						
Soldier thistle	*Picnomon acarna*		o						
Soursob	*Oxalis pes-caprae*		o						o
Spear thistle	*Cirsium vulgare*		o						
Sweet briar	*Rosa rubiginosa*		o						o
Three corner jack	*Emex australis*		o						o
Three cornered garlic	*Allium triquetrum*		o						
Variegated thistle	*Silybum marianum*		o						o
Water dropwort	*Oenantha pimpinelloides*		o			o	o		o
Wild artichoke	***Cynara cardunculus***		o						o
Yellow burrweed	*Amsinckia* spp.		o			o			o

* Lower Eyre Peninsula APC Board area only

APPENDIX C – TRANSPORT SA ROADSIDE SIGNIFICANT SITES

373 RN3163 WILMINGTON – UCOLTA Right MM48.50 - MM49.25
Aboriginal Site Pekina Creek Engraving Site. 2.4 ha within Parklands along Creek.
MARKED 3-Dec-01

901 RN3323 MURRAY TOWN – ORROROO Left MM20.95 - MM21.90
Native Vegetation *Senna* sp. Shrubland to *Austrostipa blackii* Tussock grassland. Disturbances include clearing, drainage lines, and minor exotic grass and herb invasion.
MARKED 4-Apr-02

902 RN3323 MURRAY TOWN – ORROROO Right MM20.70 - MM21.90
Native Vegetation *Senna* sp. Shrubland to *Austrostipa blackii* Tussock grassland to Callitris preissii Woodland. Disturbances include clearing, drainage lines, and minor weed invasion (exotic grasses & herbs)
MARKED 2-Jan-02

903 RN3323 MURRAY TOWN – ORROROO Right MM37.70 - MM40.06
Native Vegetation *Austrostipa blackii* Tussock grassland. Disturbances include clearing, stock grazing & movement, plantation, weed invasion (lesser guildford grass, wild wheat, horehound, wild sage).
MARKED 4-Apr-02

904 RN3323 MURRAY TOWN – ORROROO Right MM44.52 - MM44.82
Native Vegetation *Eucalyptus porosa / Eucalyptus gracilis* Low woodland. Disturbances include clearing and minor exotic grass invasion.
MARKED 2-Jan-02

905 RN3323 MURRAY TOWN – ORROROO Left MM48.07 - MM48.67
Native Vegetation *Eucalyptus porosa / Eucalyptus gracilis* Low woodland (300m) to *Senna* sp Shrubland (300m).Disturbances include clearing, and weed invasion (wild sage, horehound, guildford grass, wheat).
MARKED 2-Jan-02

907 RN3323 MURRAY TOWN – ORROROO Right MM47.67 - MM48.82
Native Vegetation 1. *Acacia calamifolia* Shrubland. 2. *Eucalyptus porosa / Eucalyptus gracilis* Low woodland. 3. *Eucalyptus gracilis* Mallee. 4. *Eucalyptus porosa* Low woodland. Disturbances include extensive clearing and grading of the last 150m of site
MARKED 2-Jan-02

APPENDIX D – SOILS IN THE PETERBOROUGH AND ORROROO/CARRIETON AREA

Base soils mapping and descriptions are from the Digital Atlas of Australian Soils described by Northcote *et al.* (1960-68) and available from the Internet at http://www.brs.gov.au/data/datasets/atlas/.

APPENDIX E – MAINTENANCE ENVELOPE DIAGRAMS

Clearance envelopes – operations able to be undertaken without Native Vegetation Council approval

Any clearance proposed here is not meant to imply or establish safety standards.

The main clearance envelope allows for the passage of legal height vehicles (4.6 m) across the full width of the traffic lanes. To allow for regrowth between pruning and sagging of branches caused by wet or windy conditions, a minimum clearance height of 5.0 m will be maintained.

Rural or non-built up areas

It is desirable to maintain a vertical clearance of 5.0m between the guideposts along a road.

The district council may seek to maintain a minimum clearance envelope that is 5.0 m high, extending the width of the road (usually taken as the edge of the traffic lane) or 7.0 m, whichever is the greater, as shown in the following Figure 1.

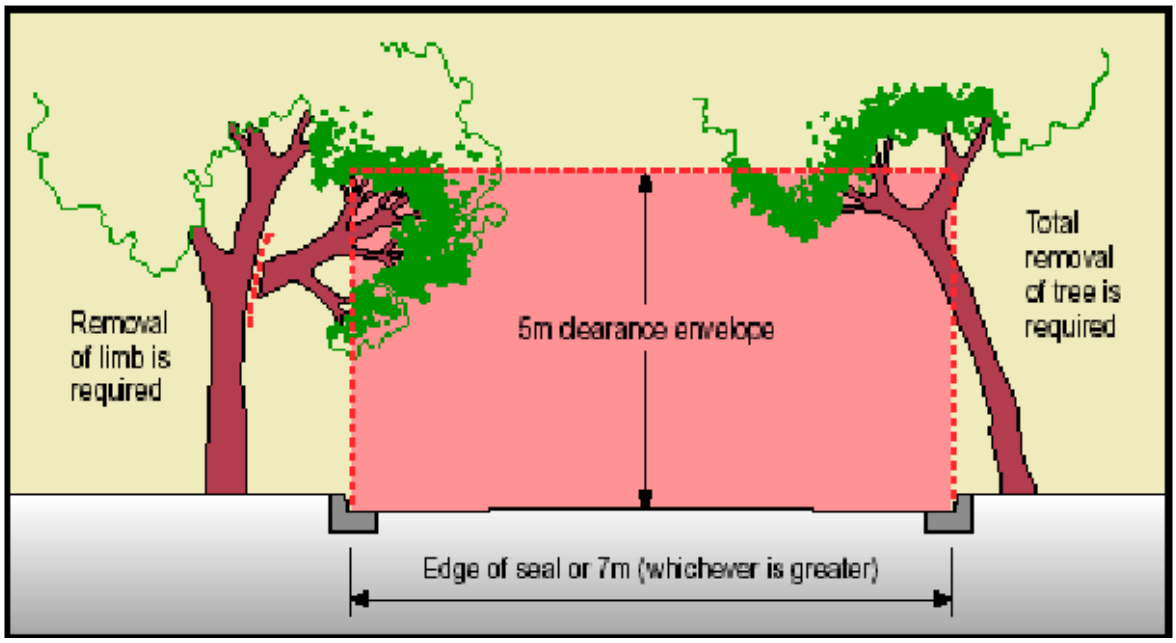


Figure 1: Rural Clearance Envelope (Minimum)

This clearance envelope may vary depending on the highway characteristics and location. Refer relevant maintenance specification and schedules.

Urban or built up areas

It is desirable to maintain a vertical clearance of 5.0m from kerb face to kerb face.

The district council may seek to maintain a minimum clearance envelope that is 5.0 m high, extending over the width of the travel lanes that are available for the passage of all legal road vehicles as shown in the following figure.

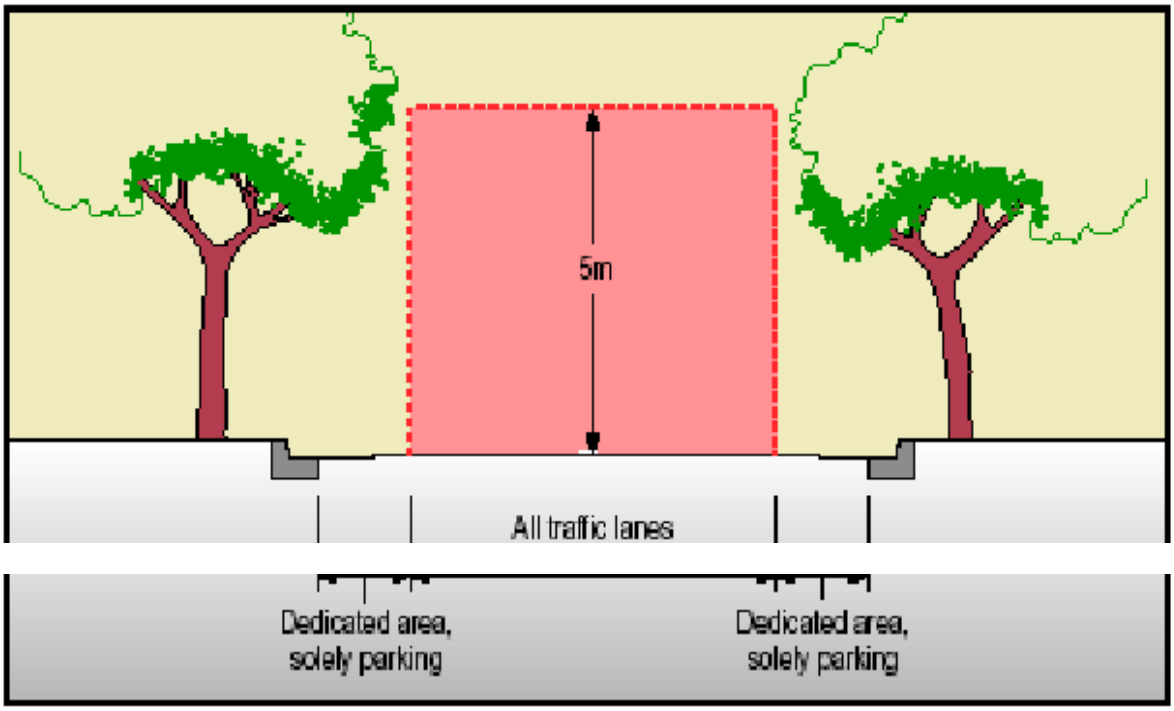


Figure 2: Urban Clearance Envelope (Minimum)

The clearance envelope is further modified on highway medians. A clear height of 2.1 m will be maintained at the kerb and extend 1.0m from the carriageway or to the nearest edge of the trunk, whichever is lesser (Figure 3).

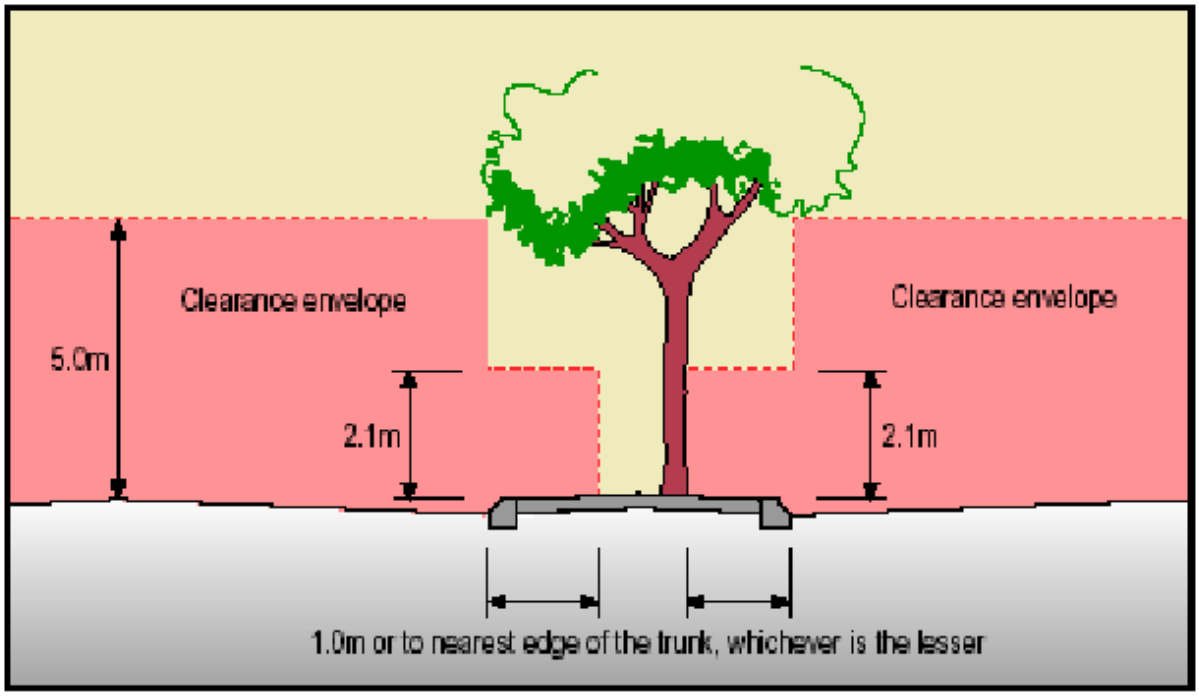


Figure 3. Change to clearance envelope at medians

A secondary clearance envelope extending upto 500 mm around roadside furniture may also be sought (Figure 4). Additional vegetation control may be undertaken on the approach side of signs and delineation devices to ensure that the sign is clearly visible from a distance equivalent to the stopping sight distance for the speed environment of the road (Figure 5).

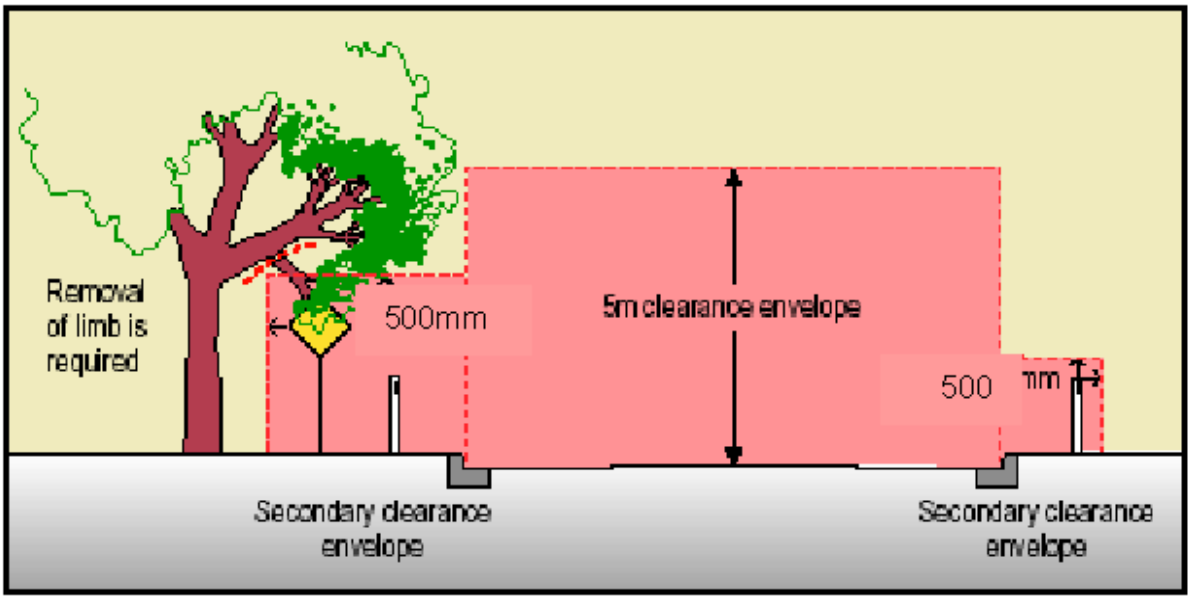
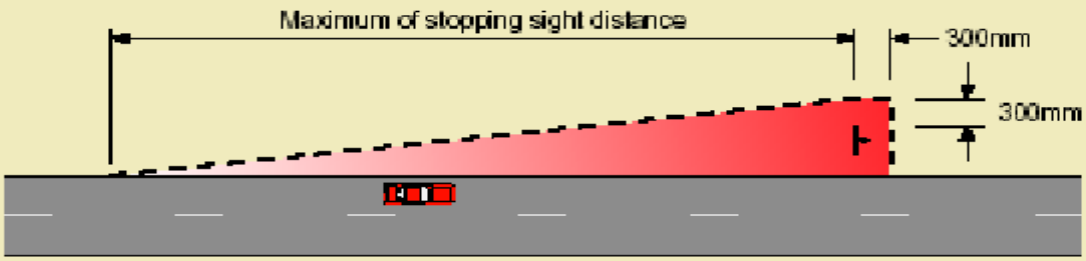


Figure 4: Secondary Clearance Envelope



85th percentile speed (km/h)	Stopping Sight Distance (m)
51-60	65
61-70	85
71-80	115
81-90	140
91-100	170
101-110	210
111-120	250

Source: extract from AS1742.2-1994, table 2.6

Figure 5: Secondary Clearance Envelope Along Road

APPENDIX F - GUIDELINE S FOR CLEARANCE OF NATIVE VEGETATION ASSOCIATED WITH THE CONTROL OF PLANT AND ANIMAL PESTS

The Native Vegetation Council Guideline – "*Clearance of Native Vegetation associated with the control of Plant and Animal Pests*", provides additional information on minimising impacts to native vegetation during pest and animal control activities. Guidelines are available on the NVC website: www.nvc.sa.gov.au

APPENDIX G – ANNUAL REPORTING FORM

Evaluation and Reporting for Local Government

The form below sets out the annual evaluation method for a RVMP. The basic template may need to be slightly modified to reflect the specific goals and requirements of a district council's RVMP. Completed reports are to be submitted to the Native Vegetation Council to confirm that district councils are using and complying with their RVMP.

Council: _____

Reporting period: _____

RVMP Title: _____

Publication Date: _____

Person completing this report: _____

Date completed: _____

Contact details: _____

1. How much roadside native vegetation has been cleared in the reporting period?
- Length of roadside ..... km
- Area of vegetation ..... ha

2. Have there been any significant clearances of vegetation? Yes/No
Please provide details (including activities such as fuel reduction burning):

Works	**Date**	**Vegetation type**	**Vegetation Management Category**	**Length/Area cleared**	**Approval source***
Eg Widening Millers Road	*May-June*	*Redgum woodland*	*3*	*50m (approx 8 trees)*	*NVC*

*Approval sources
- E – environmental staff
- C – approved consultant
- A – vegetation advisory group
- NVC – Native Vegetation Council
- NR – approval not required under the RVMP

3. How many permits have been issued for:
- Vegetation clearance (eg for property access) _____
- Seed collection _____
- Firewood collection _____
- Plant material collection _____

4. What roadside vegetation management projects are being implemented or undertaken? Please provide details below.

Project * *Note*	**Required by RVMP? Y/N**	**New project? Y/N**	**Details of project(s) and progress**
Roadside vegetation surveys*			
Roadside marker schemes*			
Rehabilitation			
Revegetation			
Weed control			
Pest animal control			
Applications for funding			
Significant sites monitoring program			

* Where timelines for these schemes have been set in the RVMP , details of progress should be provided at question 7.

5. Please provide evidence of the use of vegetation procedures or checklists by Council staff (eg copies of job environmental checklists for any work undertaken bt Works Department, copies of Council permits to clear vegetation, etc).

6. Provide details of any Incident Reports involving the unauthorised clearance of roadside vegetation.

7. Have progress/milestones in the RVMP been achieved for the following programs:

Activity	**Proposed output**	**Completed to date**
Roadside vegetation surveys	*E.g. survey 30% of roads in 2001*	*25% of roads surveyed in 2001*
Roadside marker scheme		
Other		

8. What relevant training sessions have been held? (Please provide details below).

Training Topic	**Audience**	**Number attending**	**Trainer**

9. Have roadside vegetation management issues been included for discussion in daily site works meetings and department meetings? Yes/No

- Please estimate how often: _____

10. Has the RVMP been integrated into a Council strategic management plan? Yes/No

11. Has the RVMP been integrated into existing Council management systems (e.g. administration, quality or OH&S)? Yes/No
    Please indicate which systems: _____

12. Have any vegetation management procedures (additional to those in the RVMP) been developed or implemented? Yes/No
    Please list procedures:

Procedure	Details
E.g. Vegetation assessment	*Procedure for assessment of impacts to vegetation in planning phase*

13. Have environmental checklists been developed and used for project planning and "sign-off" on vegetation issues? Yes/No
    Please attach examples: _____

14. When is the RVMP due for review? _____