CITY OF
Salisbury

BIODIVERSITY CORRIDORS ACTION PLAN

Salisbury, Sustaining Our Environment

“Biological diversity or biodiversity is defined by South Australia’s Native Vegetation Act (1991) as “the variety of life forms represented by plants, animals and other organisms and micro-organisms, the genes that they contain, and the ecosystems and ecosystem processes of which they form a part.”

Index

Index continued

Index continued

Index continued

List of Plates

List of Tables

List of Figures (Appended to end of Document)

List of Appendices

Index continued

List of Appendices continued

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1.0 Introduction

The City of Salisbury describes itself as a Living City. We understand that living in a city with a vibrant biological basis is good for our health, our view of community and for our view of ourselves.

For the city-dweller with an urban lifestyle, the urban environment provides the basis for his/her views on nature. If local-native plants and animals disappear from the urban environment, then the city-dweller will not appreciate the richness and diversity of life around them and will not necessarily be able to transfer an environmental awareness to areas outside of the city.

Urban systems are dynamic environments with their own ecology. They contain natural habitats within an overlay of man-made environments. The assemblages of locally native and introduced flora and fauna species are a direct result of human influence.

Development pressure for housing and industry can lead to significant changes to biodiversity. Such localised pressures typically lead to the creation of a simplified and poorly understood urban matrix which is unsuitable for the majority of native species that once inhabited the area.

With the intensification of the global greenhouse effect, resulting climate change and the ever increasing impact of the human ecological footprint we must become more sustainable in our use of natural resources and to significantly reduce the impacts of our ways on the planets natural systems and resources.

Conservation of biological diversity is a foundation of ecological sustainability. This Biodiversity Corridor Plan for the City of Salisbury is a critical step towards achieving this conservation goal at the local level.

This report is a response to the mandate set out in Councils Strategic Planning Framework and in particular the City of Salisbury's Game Plan (2008) which states that *"Council has a responsibility to conserve the City's natural assets through planning and decision making to prevent further loss of biodiversity significance. It is essential to establish coordinated planning for the protection and expansion of areas with biodiversity value."*

This document summarises findings from a detailed flora and fauna survey and ecological assessment of sites along the five designated biodiversity corridors where habitat and species diversity is required to be conserved, linked and expanded (Game Plan 2008). This baseline information has been used to determine conservation measures for threatened species and revegetation and habitat enhancement strategies for each corridor.

Site by site rehabilitation action plans are currently under development; along with strategies for annual monitoring of sites to determine the effectiveness of remedial measures and to propose further improvements to on-ground works.

2.0 Legislative and Policy Context

This section of the plan describes the strategic policy context in which the plan fits to ensure that it is consistent with the relevant international, national, state and local policy frameworks. Listed below are policies and legislation directly relevant to biodiversity conservation within the City of Salisbury.

2.1 International

The coastal zone of the City of Salisbury provides feeding grounds for migratory birds of the East Asia Region. A number of international agreements protect these migratory birds and their habitats. Australia is a signatory to the:

Japan Australia Migratory Bird Agreement (JAMBA 1981)
China Australia Migratory Bird Agreement (CAMBA 1988) &
Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA 2007)
Convention on the Conservation of Migratory Species of Wild Animals (1979)

2.2 National

A number of National policies and laws provide obligations and expectations on Local Government for biodiversity conservation and management. The more relevant policies and laws are described briefly below.

National Strategy for the Conservation of Australia's Biological Diversity (1996)
Conservation of biological diversity is a foundation of ecologically sustainable development and is one of the core objectives of the National Strategy for Ecologically Sustainable Development (1996).

This strategy aims to bridge the gap between current practices and future targets through the effective identification, conservation and management of Australia's indigenous biological diversity.

Environment Protection and Biodiversity Conservation Act (1999) The EPBC Act (1999) protects and manages matters of national environmental significance, including flora, fauna, ecological communities and heritage places. The Act aims to balance the protection of these crucial environmental and cultural values with our society's economic and social needs by creating a legal framework and decision-making process based on the guiding principles of ecologically sustainable development.

Within the City of Salisbury there are currently three threatened native species which are protected under this Act as at 2009.

National Local Government Biodiversity Strategy (1999)
This document represents an agreed Local Government position at the national level on the management of our biodiversity. The strategy recognises that:

- Conservation and sustainable use of our natural resources will only be achieved through local area planning and management, along with community education and participation.
- There is a willingness of Local Government across Australia to play a lead role in dealing with our most pressing and complex conservation issue—the loss of biodiversity.
- A clear and co-operative partnership arrangement is required between the three spheres of government.

2.3 State

A number of State policies and laws also provide obligations and expectations on Local Government for biodiversity conservation and management. The more relevant policies and laws are described briefly below.

South Australian Strategic Plan (2007)
The South Australian Strategic Plan (2007) has a number of targets and priority actions concerning the State's management of its biodiversity.

Of relevance to local government are targets for reduction of our ecological footprint and prevention of loss of native species through human impacts.

> The City of Salisbury describes itself as a Living City. We understand that living in a city with a vibrant biological basis is good for our health, our view of community and for our view of ourselves.

No Species Loss - A Nature Conservation Strategy for South Australia 2007-2017
No Species Loss (DEH, 2007) has been developed in response to the targets set out in the South Australia's Strategic Plan (2007).

It promotes strategic and creative thinking by government, industry and urban, rural and Indigenous communities about how best to achieve biodiversity conservation and sustainable management in South Australia during the 10 year period to 2017.

The State Natural Resources Management (NRM) Plan (2006)
The State NRM Plan (2006) guides government agencies, local government, community and industry partners to better manage, protect and enhance South Australia's natural systems - our catchments, bioregions, landscapes and ecosystems, both terrestrial and marine - whether they are managed for production, settlement or conservation.

2.4 Local

Sustainable Futures – Salisbury City Plan 2020 (2008)
The Salisbury City Plan (2008) sets out the vision and future directions of the Council as an organisation as well as the aspirations of the community.

The Plan articulates Council's Vision, *"Excellence in building a community of opportunity and spirit in a quality environment"*, and realises this can only be achieved by recognising the interconnections between social and economic development and the natural environment.

The Salisbury City Plan (2008) has the vision that Salisbury will become a sustainable City in which its residents and businesses embrace sustainability best practices as part of their day-to-day lives and activities.

The plan sets out 4 Key Directions for the City; one of which is Key Direction 2: Sustaining Our Environment (2008). This aspires to conserve and promote biodiversity, natural habitat and open space. The Biodiversity Corridors Plan falls within this Key Direction.

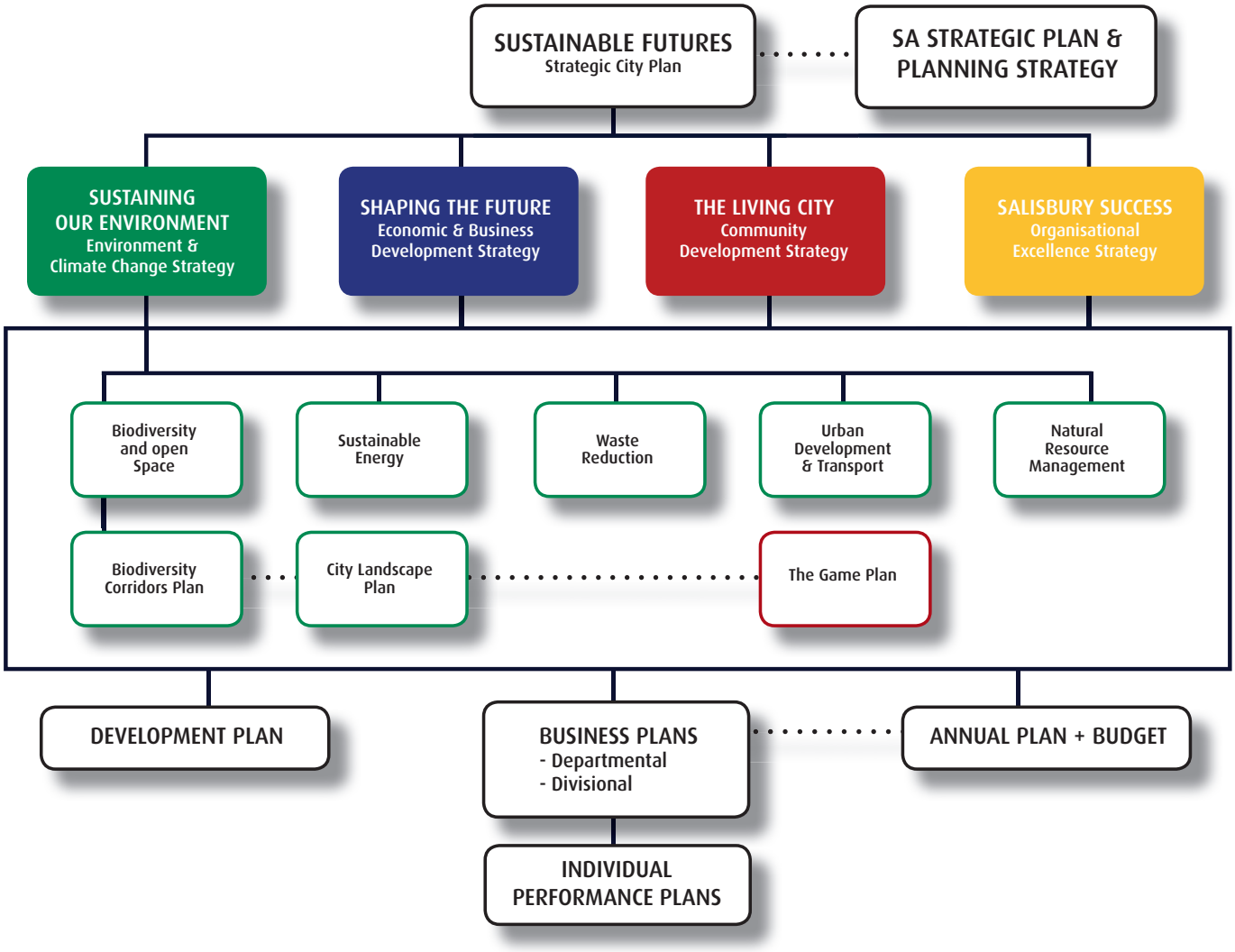
2.0 Legislative and Policy Context

The Game Plan (2008)
This plan provides a framework for Council to balance the provision of built and natural settings for physical activity as an essential element of a sustainable community.

The City of Salisbury's Game Plan (2008) has identified five biodiversity corridors where habitat and species diversity should be conserved, linked and expanded. These corridors form the basis of the biodiversity corridors detailed in this plan.

City of Salisbury Landscape Plan (2007)
This plan provides a clear set of guidelines to strengthen the unique physical characteristics of Salisbury, underpinned by the key principles of promoting biodiversity, water sensitive urban design, and crime prevention through environmental design.

Corporate Framework
The diagram below shows the corporate strategic planning framework and where the Biodiversity Corridors Plan fits within this framework.



3.0 Purpose of the Biodiversity Corridors Plan

The Biodiversity Corridors Plan aims to:

- Secure local populations of threatened species.
- Secure habitats for locally threatened fauna species.
- Link habitats along habitat corridors.
- Create a net gain in species and habitats.
- Enhance the visual experience along each of the City Trails Corridors.
- Create opportunities for community involvement.
- Ameliorate urban and climate change pressures on biodiversity.
- Capture carbon through revegetation plantings.
- Provide a budget strategy for biodiversity protection and enhancement.
- Fulfil legislative and policy requirements.

3.1 Scope of the Plan

Securing the diversity of flora, fauna and habitats along the five corridors within the City of Salisbury is the long-term objective. The following tasks have been undertaken as the basis for the plan:-

- Collation of biodiversity and historical data from all published and unpublished sources relevant for each of the corridors.
- Field data collection to fill in knowledge gaps.
- Consultation with the SA Mammal Group, SA Herpetology Group, Waterwatch and local bird specialist (John Cox).
- Identification of local icon species targeted for protection or reintroduction.
- Identification of opportunities for enhancement, management and monitoring of biodiversity along each corridor.
- Identification of site constraints which limit some species in selected locations (eg. no trees under power lines).
- Initiation of site by site revegetation and management plans.
- Determination of resourcing requirements to undertake biodiversity works for the next 10 years.

The plan aims to provide a strategic approach to setting benchmarks and implementing and funding of revegetation projects.

3.2 Community Engagement

The City of Salisbury recognises that community understanding, ownership and stewardship is necessary for long term conservation of biodiversity. This requires residents of the City of Salisbury to be informed, motivated, and engaged. Currently the City of Salisbury undertakes the following programs which it will continue to support.

- The Watershed Sustainability precinct which is the home base for NRM Educational Officers who provide programs for schools that are interested in exploring environmental sustainability, including Waterwatch and Weed Warriors.
- Engagement of the services of local community groups (e.g. Aboriginal Sobriety Group; Conservation Volunteers Australia; Friend's Groups) to collect and propagate native plant seed for revegetation works within the community garden, local schools, community sites and along the biodiversity corridors.
- Existing 'friends' groups.
- Development of environmental project opportunities for programmes such as Green Corps to develop conservation skills development and promote careers in sustainability-related industries.
- Biodiversity-related community forums and events.
- Environmental programmes in schools and tertiary institutions.
- Hosting of the Adelaide and Mount Lofty Ranges Natural Resources Management Board (NRM) Education and Catchment Care programmes
- Hosting of the Urban Biodiversity Unit (DEH) Northern Biodiversity Project Officer's position and partnering with the Urban Biodiversity Unit to implement revegetation projects.

> Tree planting is being recognised as contributing to the reduction in CO2 levels within the atmosphere, which is the greatest contributor to climate change
> City of Salisbury Landscape Plan (2007, p41)

The City of Salisbury proposes the following initiatives:

- Establish new 'friends' groups where community interest is identified.
- Promote biodiversity-friendly backyards using local-native plant species in partnership with the 'Backyards for Wildlife' program run by the Urban Biodiversity Unit (see www.backyards4wildlife.com.au/).
- Create a City of Salisbury web-page to provide educational material specifically tailored to local issues. Links to other relevant sites will also be incorporated into the web-page (eg links to NRM Education (AMLRNRMB) and Urban Biodiversity Unit (DEH) websites).
- Establish one or more community demonstration native plant gardens where local species are showcased for their amenity, habitat and biodiversity value.
- Provide biodiversity interpretive and informational signage along the City trails and wetlands.

3.3 Climate Change

Climate change predictions for South Australia indicate that by 2030:

- Average annual rainfall will decrease leading to reduced stream runoff and more severe droughts. However, rainfall events will become somewhat more intense leading to more frequent and severe storms, flooding and watercourse erosion.
- Average annual temperatures will increase leading to longer and more severe heat waves, heat stress and increased fire risk.
- Sea levels will rise with projected increases in storm surges. (See McInnes et al. 2003 and Bardsley. 2006.)

Built into the City of Salisbury biodiversity corridors plan are adaptive measures which include:

- Monitor Mangrove and Samphire migration caused by sea level rise; Create opportunities for the establishment for retreat zones.
- Weighting revegetation works with species which are relatively drought tolerant.
- Establishing most revegetation sites along the riverine corridors close to watercourses where there is an elevated local water table.
- Providing surface water during summer as drinking water for native birds and refuges for aquatic fauna.
- Selecting salt tolerant species for revegetation in near-coastal locations (e.g. Mawson Lakes & west of Salisbury Highway).
- Creating adequate fire breaks along fencelines, pathways and within revegetation sites, especially for escarpment gully sites to reduce fire hazards.

3.4 Carbon Off-sets

Revegetation for biodiversity purposes using long-lived tree and shrub species has the added benefit of capturing carbon. So too are the establishment of dedicated woodlots of local-native tree species. Native grasslands have also been shown to provide significant carbon capture by building up soil carbon levels.

Opportunity exists to use these plantings to offset a portion of the carbon footprint of the City of Salisbury.

3.5 City Trails Network

Each of the 5 biodiversity corridors will be traversed by one or more city trails. It is proposed that all landscaping undertaken adjacent city trails will be done using local indigenous plant species planted in visually appealing configurations to provide both visual amenity and biodiversity enhancement.

4.0 The Importance of Biodiversity Corridors

Biodiversity within the City of Salisbury has been declining and is at risk of further decline.

Current science indicates that 30% of the original extent of an ecological community is necessary to prevent exponential loss of species (Smith and Sivertsen 2001).

Within the City of Salisbury, only the coastal Mangrove Woodlands are present above this threshold while all other vegetation complexes are fragmented and occur at well below 30% of their original extents. Extinction of some local flora and fauna species has already occurred and more is likely unless targeted intervention is undertaken.

To conserve our biodiversity we need to conserve both species and habitats. Our thinking must primarily be focussed at the large-scale, ecosystem level (Turner 2001). This is driven by the fact that some particular types of fauna require large tracts of native vegetation for foraging and breeding. A local example is the Black-chinned honeyeater *(Melithreptus gularis gularis)* which requires a minimum of 200 hectares of tall Eucalypt woodland in order to maintain a viable population (NSW Scientific Committee 2001).

Within the City of Salisbury, large-scale biodiversity conservation opportunities occur along the corridors where significant areas of public open space are available for conservation purposes.

Biodiversity corridors serve to link discrete areas of remnant vegetation and important habitat, allowing movement of flora and fauna species, and the interchange of their genetic resources. Linking and buffering remnant native vegetation sites will expand available fauna habitat, create additional habitats and enable our native wildlife to survive and adapt to environmental change.

While the ecosystem approach underpins any biodiversity conservation measures, locally rare, threatened or endemic species require specific measures to prevent their extinction (Turner 2001). Species specific, local recovery plans are required to ensure that there are sufficient food and habitat resources available to ensure long-term survival of the target fauna species and to conserve threatened plant species.

4.0 The Importance of Biodiversity Corridors

4.1 Locating the Five Biodiversity Corridors

Five biodiversity corridors located within the City of Salisbury are the:

1. Coastal Mangrove and Samphire Corridor
2. Little Para River Corridor.
3. Dry Creek Corridor.
4. Helps Road Drainage Corridor.
5. Para Escarpment Corridor.

Collectively they provide links across the City of Salisbury from the Mangroves to the foothills. These corridors are mapped in Figure 1.

The five biodiversity corridors will correspond to five of the city trails. These are:

1. Coastal Estuary Trail.
2. Little Para Linear Trail.
3. Dry Creek Linear Trail.
4. Edinburgh Kaurna Trail.
5. Western Gullies Trail.

Future corridors such as the Northern Expressway connector road have not been examined in this current report but may be subject to future investigations.

4.2 Maximising Available Habitats along Corridors

Ideally, woodland revegetation works along the corridors should mimic pre-European landscapes with multi-vegetation strata present in a mosaic pattern over the landscape. In general, greatest fauna diversity is found where there are habitats with multiple vegetation layers. Each vegetation layer (trees, large and small shrubs, grasses, groundcovers and herbs) provides vital resources for a range of fauna species.

Past clearance of remnant native vegetation over most of the City of Salisbury has resulted in significant loss of fauna habitat.

Where remnant vegetation remains, it usually consists of the dominant tree species over sparse, native ground layer plants while the native shrub mid-strata and much of the grasses, herbs and forbs are missing. Reinstatement of the missing vegetation layers is needed to provide additional habitat types.

Reinstatement of grassland habitats is also a priority and can work well in areas where verges of paths and roads need to have lower levels of biomass to provide fire hazard reduction and safety.

Unfortunately the urban environment is now significantly modified and a number of local site constraints prevent broad scale planting of the full range of vegetation strata in an authentic configuration in many locations along each corridor.

4.3 Factors Which Impact on Biodiversity and Habitat Establishment

Corridors within the City of Salisbury link various community open spaces and are multi-faceted resources. They should provide a safe community city trails network, an environment for passive or active recreational use and also habitat for local-native flora and fauna species. Such competing multiple uses, and their management, have an impact on the sustainability of flora and fauna communities along the corridor.

Factors which affect revegetation and habitat establishment works along the corridors are discussed below.

> Biodiversity within the City of Salisbury has been declining and is at risk of further decline. Extinction of some local flora and fauna species has already occurred and more is likely unless targeted intervention is undertaken.

4.3.1 Fire Safety Requirements.

Broad, firebreaks are required adjacent public paths, residential boundaries and dense revegetation blocks to provide buffer zones. They are most critical at the top of slopes, adjacent areas of high fuel load and sites with infrastructure or valuable natural assets such as iconic trees requiring protection.

The use of chenopods (e.g. bluebushes and saltbushes) and other fire resistant plantings, along with slashed and hedged zones, may be used to improve the effectiveness of firebreaks as these plantings do contain foliage that does not combust easily due to high moisture levels and salt content.

Prostrate fire resistant species that cope well with being driven on and regular slashing, such as Atriplex semibaccata (berry saltbush), can be used as general groundcovers within the slashed zones as they provide good competition to weeds, prevent erosion, add to the biodiversity and reduce fire risk. Taller species such as Enchylaena tomentosa (ruby saltbush), Maireana brevifolia (small leaved bluebush) and *Rhagodia parabolica* (mealy saltbush) can be used to form hedges. These plantings will assist in catching embers and insulating radiant heat during fires.

See the following plates which are appended to this document:-

Plate 1 Typical Cross Section of a Fire Break Enhanced with Fire Retardant Vegetation

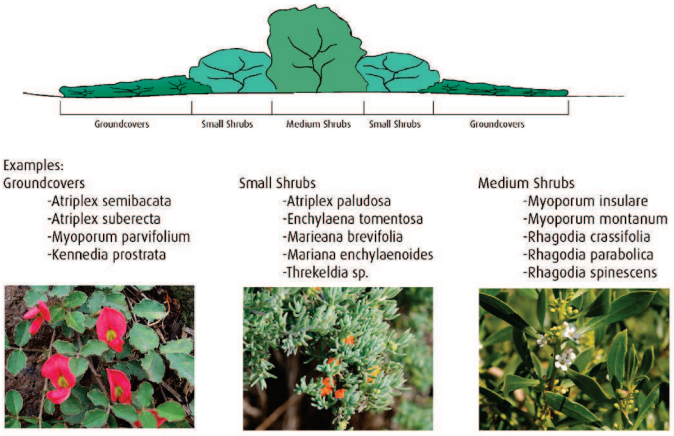


Plate 2 Revegetation Landscape Plan Incorporating Fire Break Mosaic

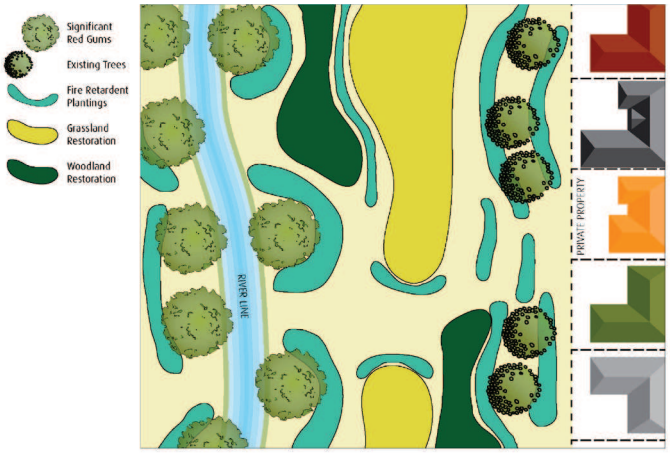
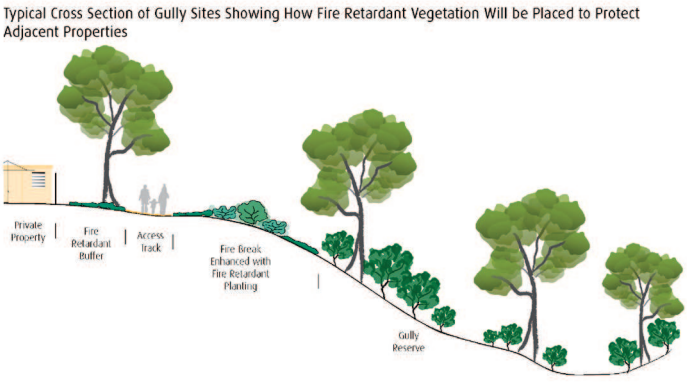


Plate 3 Typical Cross Section of Gully Sites Showing How Fire Retardant Vegetation Will be Placed to Protect Adjacent Properties



> Historically, the Adelaide region has supported a diverse range of natural habitats. Before its founding, the Adelaide plains supported almost 300 native bird species (including migratory and nomadic species), 40 mammal species, 52 reptile species, and 7 amphibian species (Turner 2001, Tait et al 2005)

4.3.2 The Need for Public Safety in Open Space

Public safety must be a high priority requiring that landscape design does not create unsafe environments such as entrapment spaces or "dead" areas (without significant pedestrian traffic). *"The basis of Crime Prevention Through Environmental Design (CPTED) is that good design and use of the built environment can reduce crime and improve City Image."* City of Salisbury Landscape Plan (2007, p106).

Areas surrounding public pathways need to be open and visible "at a glance" to promote passive surveillance in order to reduce opportunities for crime (Sarkissian 2000). In order to satisfy this need for public surveillance along the riverine corridors within the City of Salisbury the landscape has been reduced to low-lying plants or high branching trees. It is essentially devoid of middle strata shrubs. While such a landscape is desirable for public safety it has contributed significantly to loss of native flora and fauna diversity. Furthermore, this open landscape has created a dominance shift in the local native bird populations.

4.3.3 Dominance Shift in the Local Native Bird Populations

Many medium and large bodied bird species, such as the *Manorina melanocephala* (Noisy Miner) have benefited from clearing of dense middle strata vegetation and from fragmentation of remnant vegetation. Their aggressive behaviour towards nectar and insect feeding birds excludes these smaller, more passive birds, thereby further depleting the corridor of its resident fauna (Stothers et al. 1999).

Timid species such as *Malurus cyaneus* (Superb Fairy-wren) have been driven out of the corridors through a combination of loss of suitable protective shrub cover and aggressive behaviour from Noisy Miners. *'We should, therefore, be aiming to provide a habitat for these smaller birds through remediating human dominated landscapes by ...replacing missing habitat components'* (Parsons (2007).

A compromise is required in order to maintain habitat links for indigenous fauna, while at the same time protecting humans from criminal behaviour (Sarkissian 2000). For example, while it is important to ensure that any landscape planting adjacent to a pathway provides unobstructed views, there is opportunity to plant dense, bulky shrubs at a distance from these pathways and especially adjacent the watercourse from which pathways have been generally offset by quite some distance. Planting dense shrubs, including some spiky shrubs, may be the best strategy for minimising the negative effects of Noisy Miners and attracting small birds back into urban parklands and nearby gardens. (Birds in Backyards Website - accessed Feb 09)

4.3.4 Requirements by Public Utilities

Where infrastructure such as public utilities traverses biodiversity corridors, limitations are placed on revegetation works. For example, SA Water discourages large scale revegetation above buried water mains, sewers and storm water pipes and ETSA Utilities requirements prohibit the planting of trees and large shrubs beneath high voltage power lines. These corridors may, however, provide ideal sites for grassland restoration.

4.3.5 Past Pest Plant Infestations

Areas formerly occupied by dense pest plant infestation, particularly Coolatai grass *(*Hyparrhenia hirta)* need to be carefully managed as the soil there is likely to still be covered with a heavy crop of weed seeds. Planting in such locations may break the dormancy of the seeds and stimulate a fresh infestation.

4.3.6 Revegetation with High Levels of Shade

Heavy shade produced by some old remnant trees and especially dense revegetation inhibits growth of understorey plants placed beneath them, restricting the planting list to a small number of shade tolerant species only.

5.0 Biodiversity Currently Present in City of Salisbury

Since 1836:-

- The total number of native animal species decreased by 43, while 31 introduced animals are still present today;
- 50% of the native mammal species are no longer found (a decrease from 40 to 20 species);
- There has been little change in the overall number of bird, reptile and amphibian species;
- Over 600 new species of plants have been introduced, while about 90 native plant species have been lost (or 8% of the original number of native plant species). (adapted from http://www.adelaide.edu.au/news/news525.html)

The City of Salisbury is custodian to a large number of remnant native plants and animals. Current data indicates that there are:

- 269 native plant species and subspecies.
- 242 native bird species and 9 introduced bird species.
- 53 bird species are breeding within the City of Salisbury
- 39 migratory bird species visiting our coastline.
- 20 native reptile species
- 11 native mammal species and 8 introduced mammal species.
- 5 native fish and 3 introduced fish species in inland waters as well as many marine species.
- 4 native frog species.

While much of this biodiversity occurs on land owned by the City of Salisbury, a significant percentage occurs on land owned by federal, state and private agencies. For example:

- Barker Inlet Coastal Mangroves are on Crown land and are protected by the *Native Veg Act 1991* and the Minister for the Adelaide Dolphin Sanctuary.
- Cobbler Creek Recreation Park is managed by DEH.
- Parafield Airport Vernal pools are protected by the Parafield Airport Limited Environment plan.

5.0 Biodiversity Currently Present in City of Salisbury

5.1 Flora

Within the City of Salisbury, relatively undisturbed remnant natural vegetation is limited to the coastal Mangrove Woodlands. Other remnant vegetation is now highly disturbed and modified.

Past clearance of remnant native vegetation over most of the Salisbury plains and foothills has resulted in significant loss of fauna habitat. Where remnant vegetation still remains, it usually consists of the dominant tree species with much reduced diversity of native ground layer plants and native shrubs. Areas of native grasslands have been almost wiped out except in a few hard to access places.

Today most native plant species occur in relatively low numbers and many are very difficult to find. The plains have lower diversity of native flora and fauna than foothills or coastal areas; except where large wetlands have been established. Greatest flora diversity still remains where terrain is difficult to traverse (eg steep gullies) or on private land (eg Cobbler Creek Recreation Park, the Saltfields, Boral Quarry).

Revegetation efforts in the past mainly attempted to reinstate the tree and larger shrub strata only and occasionally, non-local plant species were used.

In very recent years the emphasis has been to reinstate the native grasses, ground covers and low shrubs first, prior to planting taller trees and shrubs in a configuration simulating the appropriate pre-European vegetation association of the site with assistance from the Urban Biodiversity Unit (Urban Forest) Million Trees Program.

5.1.1 Nationally Protected Vegetation Communities

No vegetation communities protected under national legislation (EPBC Act 1999) have been recorded within the City of Salisbury.

5.1.2 Nationally Protected Flora

One plant species occurs within the City of Salisbury which is rated Vulnerable under National legislation (EPBC Act 1999). This species is Bead Samphire *(Tecticornia flabelliformis* (formerly) *Halosarcia flabelliformis)*. It occurs along the edges of salt scalds within the Cheetham Saltfields immediately north of St Kilda, where the site owner currently protects it.

5.1.3 State Protected Flora

11 native plant species found within the City of Salisbury are protected under the South Australian NPW Act 1972. These are listed in Table 1 below. Several of these species are currently being planted in or near constructed wetlands thereby increasing their numbers.

Table 1 Native Plant Species occurring within the City of Salisbury which are Protected under State Legislation (NPW Act 1972)

COMMON NAME	SPECIES	SA Rating
Austral Pillwort	*Pilularia novae-hollandiae*	R
Barren Cane-grass	*Eragrostis infecunda*	R
Bead Samphire	*Tecticornia flabelliformis (formerly Halosarcia flabelliformis)*	V
Black Cotton-bush	*Maireana decalvans*	E
Five-spine Bindyi	*Sclerolaena muricata var. villosa*	R
Hoary Rush	*Juncus radula*	V
Pale Flax-lily	*Dianella longifolia var. grandis*	R
Purple Loosestrife	*Lythrum salicaria*	R
Red-leg Grass	*Bothriochloa macra*	R
Spear-grass	*Austrostipa multispiculis*	R
Wiry Dock	*Rumex dumosus*	R

Conservation Status codes in decreasing order of significance are:
E (Endangered) V (Vulnerable) R (Rare)

> Today most native plant species occur in relatively low numbers and many are very difficult to find. Greatest flora diversity still remains where terrain is difficult to traverse (eg steep gullies) or on private land.

5.1.4 Historical Vegetation Communities within The City Of Salisbury

Broad-brush mapping of historic vegetation associations for the City of Salisbury as reconstructed by Kraehenbuehl (1996) are presented in Figure 3 and also republished in the City of Salisbury City Landscape Plan (2007).

Prior to European settlement, the native vegetation associations in the northern Adelaide region varied with soil and landscape type. Coastal Mangroves dominated the water edge along the Barker Inlet.

Moving eastwards, the coastal Mangroves gave way to Samphire zones on inter-tidal and supra-tidal flats. Native grasslands dominated the lower alluvial plain while the upper alluvial plain and foothills were covered in Mallee Box Open Woodlands.

Traversing across this landscape were watercourses lined with Red Gum Woodlands. Within the current City of Salisbury boundary, five broad vegetation associations predominated (see Table 2). Vegetation associations intergraded with one another so no clear line of demarcation occurred between them.

Table 2 Pre-European Vegetation Associations across the City of Salisbury Council area (after Kraehenbuehl 1996).

Vegetation Association	Soil Description	Landscape Type
Avicena marina (Mangrove) Low Woodland	Estuarine mud and Sands	Tidal flats
Mixed Halosarcia spp. (Samphire) *Sclerostegia spp.* (Samphire) *Atriplex paludosa* (Marsh Saltbush) *Sarcocornia spp.* (Samphire) Low Shrubland	Estuarine mud and Sands	Tidal flats
Austrostipa sp. (Spear Grass), *Austrodanthonia sp.* (Wallaby Grass) Grassland	Red brown earths (red brown clay to red brown sandy clay)	Plains
Eucalyptus porosa (Mallee Box) Woodland	Brown solonised soil, terra rossa. Black earth, red-brown clay and rendzinas	Foothills south of the Little Para River and plains north of the Little Para River
Eucalyptus camaldulensis (River Red Gum) +/- *Eucalyptus leucoxylon* (SA Blue Gum) Woodland	Alluvial soils	Watercourse

Each of the vegetation associations is described briefly, below.

5.1.4.1 Avicena marina (Mangrove) Low Woodland

Avicennia marina (Mangrove) woodlands occurred in the sheltered intertidal zone of Barker Inlet. Few plant species occurred in conjunction with *Avicennia marina* (Mangrove) as the highly saline soils excluded all but the most salt tolerant species.

Kraehenbuehl (1996) originally listed only 6 salt tolerant plant species present within this association. Mangrove areas still provide significant habitat for migratory and endemic bird species and are a nursery for numerous marine, intertidal species.

Today, this vegetation association appears to be expanding despite considerable disturbance in the past as its former range has been altered by the construction and susequent breaching of sea walls.

Within Barker Inlet, Mangrove areas are expanding as there is a landward migration into the adjacent intertidal Samphire communities due to soil subsidence (Fotheringham 1994, Coleman 1998).

5.0 Biodiversity Currently Present in City of Salisbury

5.1.4.1 *Mixed Halosarcia spp.* (Samphire) *Sclerostegia spp.* (Samphire) *Atriplex paludosa* (Marsh Saltbush) *Sarcocornia spp.* (Samphire) Low Shrubland

Samphire species such as *Sclerostegia spp* (now *Tecticornia spp*), *Halosarcia spp,.* and *Sarcocornia spp* occurred on inter-tidal and supra-tidal, lower lying, highly saline areas. They also occurred on near-coastal, stranded salt scalds.

This mosaiced vegetation association spread several kilometers inland of the *Avicennia marina* (Mangrove) woodlands. More elevated, better drained sites were dominated by saltbush species such as *Atriplex paludosa* (Marsh Saltbush) which were occasionally accompanied by taller shrubs such as *Nitraria billardierei* (Nitre Bush).

The Cheetham Saltfields now cover most of the historical samphire low shrubland areas within the City of Salisbury. Kraehenbuehl (1996) originally listed 52 plant species historically associated with this association.

Today, this vegetation association has been significantly reduced in area to make room for the Cheetham Saltfields and Bolivar Waste Water Treatment Plant sites. Through draining and filling of these areas....the natural soil profile and plant communities have been drastically altered. City of Salisbury Landscape Plan (2007, p34).

This vegetation association continues to experience threats from invasion by Mangroves and decline where Samphires have become stranded from tidal influence due to sea wall/levee bank construction. This association has a number of variations in species combinations due to man-made alterations to the landscape e.g. locations now stranded from tidal influence as a result of sea wall construction, differ in species dominance and range from locations under tidal influence.

Samphire low shrublands still provide important habitat for a number of threatened bird species, including *Acanthiza iredalei rosinae* (Slender-billed Thornbill) (Edyvane 2000).

5.1.4.3 *Austrostipa sp.* (Spear Grass), *Austrodanthonia sp.* (Wallaby Grass) Grassland

This plant community is characterised by large open areas dominated by native grasses, groundcovers and annual plants, on the red-brown earth soil associations of the lower alluvial plain. Emerging above the grassland was a sparse scattering of *Eucalyptus camaldulensis* (River Red Gum) and *Acacia pycnantha* (Golden Wattle) trees and occasional shrubs and saltbushes. Kraehenbuehl (1996) listed 76 plant species historically associated with this association.

Within the northern Adelaide plains including the City of Salisbury, remnant native grasslands in good condition are very uncommon. Historic native grasslands were highly sought after for grazing and agriculture causing them to be rapidly cleared. Remnants are reduced to small isolated pockets (e.g. along road and rail verges or small sections of reserves) with a limited species range. Surviving remnant native grasses are forced to compete for space with pasture grass weeds.

Neagle (1995) considered that *Austrostipa spp.* (Speargrass), *Austrodanthonia spp.* (Wallaby Grass) Grasslands were adequately conserved throughout the remainder of South Australia. Furthermore this vegetation community is not listed as a threatened ecosystem within South Australia (DEH 2005). However, the Adelaide Mount Lofty Ranges Natural Resources Management Board (AMLR 2009) lists remnant native grassy patches including that *Austrostipa spp.* (Speargrass), *Austrodanthonia spp.* (Wallaby Grass) Grasslands as priority ecological communities for conservation.

Recent (2009) unpublished investigations of diaries of early explorers (1839-1850) suggest that the dominant grass species across the Adelaide Plains was originally Themeda triandra (Kangaroo Grass). This highly palatable grass was rapidly lost though grazing and the grasslands were subsequently recolonised by *Austrostipa spp.* (Speargrass) and *Austrodanthonia spp.* (Wallaby Grass) as these grass species are more resistant to disturbance. (Adrian Shackley pers com)

> The emphasis has been to reinstate the native grasses, ground covers and low shrubs first, prior to planting taller trees and shrubs in a configuration simulating the appropriate pre-European vegetation association of the site

Themeda triandra +/- Danthonia spp. Tussock Grassland on heavy, fertile soils of plains and hill slopes are listed as endangered ecosystems within South Australia in DEH's provisional list of threatened ecosystems for SA (DEH 2005). Furthermore the Adelaide Mount Lofty Ranges Natural Resources Management Board (AMLR 2009) lists remnant native grassy patches including *Themeda triandra +/- Austrodanthonia spp.* Tussock Grasslands as priority ecological communities for conservation.

5.1.4.4 *Eucalyptus porosa* (Mallee Box) Woodland

Within the City of Salisbury, *Eucalyptus porosa* (Mallee Box) Woodlands occurred along the Para Escarpment south of the Little Para River, and on the plains north of Waterloo Corner Road. *Eucalyptus porosa* (Mallee Box) would occasionally be accompanied by other tree species such as *Callitris gracilis* (Southern Cypress Pine) and *Allocasuarina verticillata* (Drooping Sheoak). Tree density varied depending on the location, with greatest density on hilltops and in gullies. Density decreased on the plains and hill slopes with open areas covered mostly by grassland dominated by Themeda triandra (Kangaroo Grass).

The mid storey in wooded areas typically consisted of sparsely distributed medium-sized shrubs and a well developed grassy-herbaceous understorey. Kraehenbuehl (1996) listed 65 plant species historically associated with this association. Milne, Croft, & Pedler (2003) reported that 25 or more species could be expected to occur within a healthy 30x30m quadrat.

Today this vegetation association still occurs in a number of gully reserves and within the Cobbler Creek Recreation Park. However, *Eucalyptus porosa* (Mallee box) Woodland has been almost completely cleared on the plains (north of Waterloo Corner Road) and now occurs as isolated remnant trees within RAAF Base Edinburgh and Harry Bowey Reserve.

As a result of significant state wide clearance of this association, this type of woodland is listed in Neagle (1995) as having a Priority 5 conservation category as it is poorly conserved in South Australia. However, *Eucalyptus porosa* (Mallee Box) woodlands are not listed by DEH as a threatened ecosystem within South Australia (DEH 2005).

5.1.4.5 *Eucalyptus camaldulensis* (River Red Gum) +/- *Eucalyptus leucoxylon* (SA Blue Gum) Woodland

These woodlands formerly occurred along drainage lines of the northern Adelaide Plains and Hills. *Eucalyptus camaldulensis* (River Red Gum) lined the watercourses generally accompanied by thickets of *Acacia salicina* (Willow Wattle). *Eucalyptus leucoxylon* (SA Blue Gum) trees occurred on more elevated soils often at a distance from the watercourse. Understorey species composition varied significantly depending on location and may have comprised of reedbeds +/- relatively open grassy understorey, including sedges and rushes of river floodplains, or a more dense and diverse understorey of medium-sized shrubs. Kraehenbuehl (1996) listed 177 plant species historically present within this association.

Today, within the City of Salisbury watercourses still support tall woodlands of *Eucalyptus camaldulensis* (River Red Gum) trees. Most are large, mature trees qualifying as significant trees under the Development Act 1993 (SA). Little remnant native riparian vegetation occurs along local watercourses apart from isolated individuals or clusters of *Acacia salicina* (Willow Wattle). Turner (2001) listed only 14 remnant native species present of the original 177 or so species along the Little Para river Corridor.

Remnant *Eucalyptus leucoxylon* (SA Blue Gum) trees are lacking from the City of Salisbury today except for one stand of 5 mature trees on the City of Playford's side of Harry Bowey Reserve. All other *Eucalyptus leucoxylon* (SA Blue Gum) trees present within the City of Salisbury were planted, often with the non-local, but visually more appealing large-fruited form, *Eucalyptus leucoxylon ssp. megalocarpa* (Large–fruited SA Blue Gum). This form originated from the South East of SA.

Neagle (1995) considered that *Eucalyptus camaldulensis* (River Red Gum) *+/- Eucalyptus leucoxylon* (SA Blue Gum) Woodlands are adequately conserved in South Australia. Furthermore this community is not listed as a threatened ecosystem within South Australia (DEH 2005).

5.0 Biodiversity Currently Present in City of Salisbury

5.1.4.6 Near Coastal Swamplands & Constructed Wetlands

Whilst not recorded in Kraehenbuehl (1996) as a distinct vegetation association, the lower alluvial plain, which contained the outwash fans of the Dry Creek and Little Para Rivers, had a scattering of shallow swampy depressions which supported their unique suite of flora and microfauna including localised *Gahnia filum* (Thatching Grass) sedge lands and their co-dependent native Yellowish Sedge Skipper Butterfly *(Hesperilla flavescens flavia).*

These swamplands have subsequently been drained and cleared over time except for a small area present at the southern end of the Parafields Airport land where a dozen or so shallow, ephemeral swampy pools are still preserved.

In the place of the coastal swamplands, The City of Salisbury has installed a series of constructed stormwater wetlands such as those at Greenfields and Little Para Estuary.

The larger wetlands built in the City of Salisbury such as Greenfields, Kaurna Park and the Paddocks not only detain stormwater but also cleanse it sufficiently for injection into an aquifer. However, as these major wetlands dry out during summer droughts they have a limited range of aquatic macrophyte species capable of tolerating the extremes in wet/dry conditions.

More recently designed and built wetlands such as those in Springbank Waters have sections retaining surface water all year round. This provides growing conditions which allow many drought-intolerant macrophyte and herb species to survive and thrive.

Smaller wetlands, which are scattered throughout the suburbs, function as stormwater detention basins after rain events, providing useful local amenity and refuges for local biodiversity. However, as these basins dry out during extended dry periods, they also have a limited range of native plant species present.

5.2 Fauna

Within the City of Salisbury, greatest fauna diversity occurs where:

- Multiple vegetation strata occur.
- Permanent water is available (eg. wetlands, Saltfields,)
- Large tracts of land occur (eg Cobbler Creek RP, Saltfields, Mangroves).

Urban open space within the City of Salisbury consists mostly of tall eucalypt trees over open lawn, which favours a relatively small range of native birds that adapt well to this type of landscape such as the Australian Magpie *(Gymnorhina tibicen),* Magpie-lark *(Grallina cyanoleuca),* and Willie Wagtail *(Rhipidura leucophrys).*

The abundant flowers produced by the eucalypt trees tend to encourage the larger, more aggressive nectar-feeders such as Noisy Miners *(Manorina melanocephala),* Rainbow Lorikeets *(Trichoglossus haematodus)* and Red Wattlebirds *(Anthochaera carnunculata).*

Urban gardens also tend to have open aspects and are frequently planted with abundant nectar producing plants; again favouring a wider range of common nectar-feeders including the New Holland Honeyeaters *(Phylidonyris novaehollandiae)* and White-plumed Honeyeaters *(Lichenostomus penicillatus).*

The proliferation of wetlands within the City of Salisbury has resulted in a significant increase in water birds including ducks, spoonbills, herons, pelicans, cormorants and migratory waders.

Small, insectivorous birds (such as wrens) and finches are most disadvantaged in urban habitats and open space within the City of Salisbury through lack of sufficient food resources, predation by cats and aggressive behaviour of Noisy Miners *(Manorina melanocephala).*

Small, insectivorous birds require a dense, shrubby understorey in which to shelter and forage (Parsons 2007). This habitat type occurs too sparsely or is too widely spaced along our corridors for the small birds to safely migrate from one location to another. Finches are mainly seed eaters requiring suitable native grassy seed sources which are generally lacking.

> "Urban open space within the City of Salisbury consists mostly of tall eucalypt trees over open lawn, which favours a relatively small range of native birds that adapt well to this type of landscape"

We should, therefore, be aiming to provide a habitat for these smaller birds through remediating human dominated landscapes by minimising the further removal and fragmentation of natural vegetation and replacing missing habitat components (Parsons 2007).

When compared to pre-European days, the current mammal population is significantly depleted in species. As a group, the micro bats have the greatest number of species occurring within the urban environment.

Two species of possum inhabit urban creeklines and nearby domestic properties. Western Grey Kangaroos *(Macropus fuliginosus*) and Euros *(Macropus robustus*) are occasionally seen along the coast and in the Upper Little Para Reserve. Koalas, which are not endemic to the Adelaide region, are now increasing in number along the Para escarpment. As a group, the micro bats have the greatest number of species occurring within the urban environment. However, feral mammals have become relatively common. These include predators such as foxes and cats and herbivores such as hares, rabbits, rats and mice.

Reptiles have suffered the least extinctions on the northern plains with species diversity only slightly reduced since pre-European times. However, numbers of individuals within each surviving species is dramatically reduced.

Four frog species commonly occur with one or more of these species occurring in every watercourse and wetland within the City of Salisbury.

Waterwatch data indicates that macro-invertebrate populations are greater in areas of better water quality such as permanent wetlands and the upper reaches of the Little Para River. Seaman (2002) observes that *"there is a clear connection between wetland sites with a high abundance and diversity of vegetation and wetlands with high invertebrate diversity"*. The status of most other insect groups present within the City of Salisbury has not been determined.

Native butterfly species are generally in decline as their native host plants have been reduced in number. A local recovery plan to save the Yellowish Sedge Skipper Butterfy *(Hesperilla flavescens flavia)*, considered one of South Australia's rarest butterfy species, has probably been unsuccessful due to loss of large near-coastal areas of Thatching Grass *(Gahnia filum);* its host plant.

Five freshwater native fish occur in near-coastal waterways while two of these have been observed in inland waterways. Exotic carp and Eastern Gambusia (Mosquito Fish) continue to be a problem in wetlands and waterways.

Coastal Mangroves and adjacent seagrass beds are a nursery and feeding ground for juveniles and adults of many marine fish and shellfish species including many commercially and recreationally important species.

5.2.1 Nationally Protected Fauna

Two nationally protected species (EPBC Act 1999) occur within the City of Salisbury with both being rated as Vulnerable. These species are the:

- Flinders Ranges Worm-lizard *(Aprasia pseudopulchella)* which has been recorded in stony habitats of the Little Para River Linear Park, upstream of Main North Road, and at the nearby Cobbler Creek Recreation Park.

- Australian Painted Snipe *(Rostratula australis)* which has been recorded at four major wetlands within the City of Salisbury including Greenfields, The Paddocks, Kaurna Park and Whites Road Wetlands. In February 2009 this species has begun breeding at the Greenfields Stage 3 Wetlands (John Cox pers com).

5.2.2 State Protected Fauna

31 bird species occur within the City of Salisbury which are protected under the SA NPW Act (1972). Some are only occasional visitors to the Saltfields or local wetlands.

All state-protected species recorded for the City of Salisbury are listed in Table 3 below. Four of these species are known to be breeding in wetlands within the City of Salisbury.

They are marked within Table 3.

5.0 Biodiversity Currently Present in City of Salisbury

Table 3 Native Bird Species occurring within the City of Salisbury which are Protected under State Legislation (NPW Act 1972)

SPECIES	COMMON NAME	SA Rating
Acanthiza iredalei rosinae	Slender-billed Thornbill	V
Anas rhynchotis (Breeding)	Australasian Shoveler	R
Biziura lobata	Musk Duck	R
Botaurus poiciloptilus	Australasian Bittern	V
Calyptorhynchus funereus	Yellow-tailed Black Cockatoo	V
Cereopsis novaehollandiae	Cape Barren Goose	R
Chrysococcyx lucidus	Shining Bronze-cuckoo	R
Cisticola exilis	Golden-headed Cisticola	R
Coracina papuensis	White-bellied Cuckoo-shrike	R
Coturnix ypsilophora	Brown Quail	V
Falco peregrinus	Peregrine Falcon	R
Gallinago hardwickii	Latham's Snipe	V
Haliaeetus leucogaster	White-bellied Sea-eagle	V
Melithreptus gularis gularis	Black-chinned Honeyeater	V
Neophema chrysostoma	Blue-winged Parrot	V
Neophema petrophila	Rock Parrot	R
Numenius madagascariensis	Eastern Curlew	V
Oxyura australis (Breeding)	Blue-billed Duck	R
Pandion haliaetus	Osprey	R
Plegadis falcinellus	Glossy Ibis	R
Podiceps cristatus	Great Crested Grebe	R
Porzana pusilla (Breeding)	Baillon's Crake	R
Rostratula australis (Breeding)	Painted Snipe	R
Stagonopleura guttata	Diamond Firetail	V
Sterna albifrons	Little Tern	V
Sterna hirundo	Common Tern	R
Sterna nereis	Fairy Tern	V
Stictonetta naevosa	Freckled Duck	V
Thinornis rubricollis (syn. Charadrius rubricollis)	Hooded Plover	V
Turnix varia	Painted Button-quail	V
Zoothera lunulata	Bassian Thrush	R

Scientific & Common Names follow Chistidis & Boles (2008)
Conservation Status codes in decreasing order of significance are:
E (Endangered) V (Vulnerable) R (Rare)

5.2.3 Migratory Birds Protected under International Agreements

39 migratory bird species protected under agreements with Japan, China and the Republic of Korea have been recorded at the Cheetham Saltfields and a number of wetlands within the City of Salisbury. These are listed in Table 4. In recent summers, fewer migratory species have visited local wetlands presumably due to drought conditions resulting in insufficient water being present. (John Cox pers. com).

Table 4 Migratory Bird Species visiting the City of Salisbury which are Protected under Agreements with Japan, China and Republic of Korea.

SPECIES	COMMON NAME	JAMBA	CAMBA	ROKAMBA
Apus pacificus	Fork-tailed Swift (White-rumped Swift)	✓	✓	✓
Arenaria interpres	Turnstone (Ruddy Turnstone)	✓	✓	✓
Bubulcus ibis (Ardea ibis)	Cattle Egret	✓	✓	
Calidris acuminata	Sharp-tailed Sandpiper	✓	✓	✓
Calidris bairdii	Baird's Sandpiper	✓		
Calidris canutus	Red (Lesser) Knot	✓	✓	✓
Calidris ferruginea	Curlew Sandpiper	✓	✓	✓
Calidris melanotos	Pectoral Sandpiper	✓		✓
Calidris ruficollis	Red-necked Stint	✓	✓	✓
Calidris subminuta	Long-toed Stint		✓	
Calidris tenuirostris	Great Knot	✓	✓	✓
Charadrius leschenaultii	Greater Sand Plover	✓	✓	✓
Charadrius veredus	Oriental Plover			✓
Chlidonias leucopterus	White-winged Black Tern	✓	✓	
Gallinago hardwickii	Latham's Snipe	✓		✓
Glareola maldivarum	Oriental Pratincole		✓	✓

> When compared to pre-European days, the current mammal population is significantly depleted in species. As a group, the micro bats have the greatest number of species occurring within the urban environment.

SPECIES	COMMON NAME	JAMBA	CAMBA	ROKAMBA
Haliaeetus leucogaster	White-bellied Sea-eagle		✓	
Limicola falcinellus	Broad-billed Sandpiper	✓	✓	✓
Limosa lapponica	Bar-tailed Godwit	✓	✓	✓
Limosa limosa	Black-tailed Godwit	✓	✓	✓
Numenius madagascariensis	Eastern Curlew	✓	✓	✓
Numenius minutus	Little Whimbrel (Curlew)	✓		✓
Numenius phaeopus	Whimbrel	✓	✓	✓
Phalaropus lobatus	Red-necked Phalarope	✓	✓	✓
Philomachus pugnax	Ruff (Reeve)	✓	✓	✓
Plegadis falcinellus	Glossy Ibis		✓	
Pluvialis dominicus	Eastern Golden Plover	✓	✓	
Pluvialis fulva	Pacific Golden Plover			✓
Pluvialis squatarola	Grey (Black-bellied) Plover (Grey Plover)	✓	✓	✓
Puffinus tenuirostris	Slender-billed Shearwater (Short-tailed Shearwater)	✓		✓
Stercorarius parasiticus	Parasitic Jaeger (Arctic Jaeger)	✓		✓
Sterna albifrons	Little Tern	✓	✓	✓
Sterna bergii	Crested Tern	✓		
Sterna hirundo	Common Tern	✓	✓	✓
Tringa glareola	Wood Sandpiper	✓	✓	✓
Tringa nebularia	Greenshank (Common Greenshank)	✓	✓	✓
Tringa stagnatilis	Marsh Sandpiper (Little Greenshank)	✓	✓	✓
Tringa totanus	Redshank (Common Redshank)		✓	✓
Xenus cinereus (Tringa terek)	Terek Sandpiper	✓	✓	✓

Scientific & Common Names follow Chistidis & Boles (2008)
JAMBA = Protected under Japan Australia Migratory Bird Agreement
CAMBA = Protected under China Australia Migratory Bird Agreement
ROKAMBA = Protected under Republic of Korea Australia Migratory Bird Agreement

5.3 Current Threats to Biodiversity Conservation

Changing environmental conditions coupled with competition from both exotic flora and fauna and overabundant native species put pressures on the remnant biodiversity within the city of Salisbury. Table 5 summarises threats to biodiversity within the City of Salisbury.

Table 5 Threats to Biodiversity within the City of Salisbury.

Threat	Comments
Proclaimed Weeds	These are generally well controlled in City of Salisbury reserves.
Environmental Weeds	Not controlled but are serious threats to native plants.
Overabundant Native Plants	Some native species, imported from other regions or states are spreading rapidly and out-competing or smothering local native species.
Feral Birds	Starlings, pigeons, sparrows, blackbirds etc compete with local birds for resources.
Aggressive local birds	Compete with timid birds for territories and resources.
Exotic fish	Carp and Eastern Gambusia cause a decline in native fish numbers.
Feral Bees	Occupy tree hollows preventing occupation by bats, possums and parrots.
Feral predators	Foxes and cats prey on small native animals
Feral herbivores	Rabbits, hares, rats and mice damage native vegetation.
Watercourse erosion	Leads to loss of riverine habitat.
Human activity	People and their dogs, horses and other animals in reserves can impact on native species in various ways.
Climate change	Harsher conditions impact on flora and fauna survival.

5.0 Overview of Salisbury's Biodiversity Corridors

As stated earlier, the biodiversity corridors within the City of Salisbury are the:

- Coastal Mangrove and Samphire Corridor
- Little Para River Corridor.
- Dry Creek Linear Corridor.
- Helps Road Drainage Corridor.
- Para Escarpment Corridor.

The current state of the 5 biodiversity corridors is summarised below.

6.1 Native Plant Numbers along the Five Corridors

Numbers of remnant native plant species recorded within the five (5) corridors is summarised in Table 6. Revegetation has added many species previously lost from the corridors. Numbers of plant species reinstated to the corridors through revegetation are also listed.

The Para Escarpment Corridor has the greatest native plant diversity within the City of Salisbury, with 151 recorded species. 89 plant species are found within the Cobbler Creek Recreation Park, with a further 62 others found in other reserves. 2 reserves have more than 70 plant species while a further 3 reserves have more than 50 species recorded.

Table 6 Numbers of Native Plant Species along Each Corridor, Occurring as Remnant Plants or as Revegetation.

Corridor	Number of Naturally Occurring Native plant species recorded	Number of extra Native Plant Species added through Revegetation
Coastal Mangroves and Samphires Corridor (Includes Saltfields)	90	0
Little Para River Corridor (Includes Estuary Wetlands)	44	31
Dry Creek Corridor (Includes Greenfields Wetlands)	64	36
Helps Road Drain System (Includes 5 Wetlands)	29	77
Para Escarpment	151	18

6.2 Bird Species Found Along Each Corridor

Bird data recorded along each corridor is summarised in Table 7 below.

Table 7 Bird Data for Each Corridor Within the City of Salisbury

Corridor	Total Number of Bird Species Recorded	Nationally Threatened Birds (EPBC Act 1999)	State Threatened Birds (NPW Act 1972)	Migratory Bird Visitors
Coastal Mangroves and Samphires Corridor (includes Saltfields)	204	0	22	37
Little Para River Corridor (Includes Estuary Wetlands)	80	0	4	2
Dry Creek Corridor (Includes 4 Wetlands)	176	1	17	22
Helps Road Drain System (Includes 5 Wetlands)	121	1	12	9
Para Escarpment	113	0	5	1

> The Para Escarpment Corridor has the greatest native plant diversity within the City of Salisbury, with 151 recorded species. 89 plant species are found within the Cobbler Creek Recreation Park, with a further 62 others found in other reserves. 2 reserves have more than 70 plant species while a further 3 reserves have more than 50 species recorded.

6.3 Other Fauna Found Along Each Corridor

Data for non-avian fauna recorded along each corridor is summarised in Table 8.

Table 8 Numbers of Other Fauna Species Recorded along Each Corridor.

Corridor	Reptiles	Mammals	Frogs	Native Fish
Coastal Mangroves and Samphires Corridor (includes Saltfields)	10	6	2	1
Little Para River Corridor (Includes Estuary Wetlands)	9	4	4	4
Dry Creek Corridor (Includes Greenfields Wetlands)	8	7	4	5
Helps Road Drain System (Includes 5 Wetlands)	9	4	no data	1
Para Escarpment	8	5	1	n/a
Urban Areas	4	3	2	n/a

6.4 Rating Vegetation Condition in the City Of Salisbury

Where appropriate, the condition of remnant vegetation along each biodiversity corridor is given a rating using Turner's (2001) condition scale. Turner's (2001) scale is reproduced in Table 9. Vegetation condition for each of the biodiversity corridors is mapped in Figure 2.

Neither Turner (2001) nor other authorities provide a condition scale for sites revegetated on totally cleared land, such as the wetlands within the City of Salisbury. Where such sites occur, the condition of the vegetation present has been rated as if that vegetation had been remnant to the site and assigned a value using Turner's (2001) condition scale.

Table 9 Vegetation Condition Scale (after Turner 2001)

Condition Scale	Description
Pristine (1)	Pristine. Or nearly so, no obvious signs of disturbance.
Excellent (2)	Vegetation structure intact, disturbance affecting individual species and weeds are non- aggressive species.
Very Good (3)	Vegetation structure altered, obvious signs of disturbance eg. disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
Good (4)	Vegetation structure significantly altered by very obvious signs of multiple disturbance. Retains basic vegetation structure or ability to regenerate it eg. disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds, partial clearing, dieback and grazing.
Degraded (5)	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management eg. disturbance to vegetation structure by very frequent fires, the presence of very aggressive weeds at high density, partial clearing, dieback and grazing.
Completely Degraded (6)	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weeds or crop species with isolated native trees or shrubs

7.0 Coastal Mangrove and Samphire Corridor

The Barker Inlet Mangroves are zoned as Metropolitan Open Space. Furthermore, all remnant native vegetation including Mangroves and Samphires found west of Port Wakefield Road is protected under the Native Vegetation Act 1991 (SA) as defined by the Native Vegetation (Miscellaneous) Amendment Bill 2002 but subject to a low number of exemptions under the Native Vegetation Regulations.

7.1 Mangroves

Fotheringham (1994) describes this zone as *Avicennia marina* (Grey Mangrove) dense low forest to low woodland while Kraehenbuehl (1996) considered the vegetation structure to be open woodland only. *Avicennia marina* (Grey Mangrove) is found on tidal flats of estuarine mud and sands forming extensive communities spreading up to 2km wide around Barker Inlet. Mangrove tree height decreases with distance from the sea or from tidal creeks. Mangrove trees can be 6m tall or more on the seaward edge of the zone dropping to 2.5m in the landward edge. On the more elevated parts of this zone, wherever sunlight is able to reach the woodland floor, *Tecticornia arbuscula (syn. Sclerostegia arbuscula)* (Shrubby Samphire) and *Sarcocornia quinqueflora* (Beaded Samphire) occur as an understorey (Fotheringham 1994). Elevated mounds adjacent constructed canals through the mangrove woodland support large *Nitraria billardierei* (Nitre-bush) shrubs. Kraehenbuehl (1996) lists only 5 understorey plant species occurring in the Mangroves with no weed species recorded; presumably kept out by the highly saline environment. Extent of Mangrove communities within the City of Salisbury is shown in Figure 1.

Within Barker Inlet, Mangrove areas are expanding as there is a landward migration into the adjacent intertidal Samphire communities (Fotheringham 1994, Coleman 1998) due to land subsidence of the Samphire zones (Coleman pers. com).

Mangroves provide shelter for the juveniles and adults of many marine fish and shellfish species including many commercially and recreationally important species (Stewart & Fairfull 2008). Mangroves also provide significant habitat for other forms of wildlife especially water birds.

Native plant species recorded for the Mangrove communities within the City of Salisbury from published and unpublished sources are listed in APPENDIX 1.

7.1.1 Condition of Mangrove Vegetation

Coastal Mangroves are considered to be in excellent condition due to their relatively undisturbed nature i.e. corresponding to Turner (2001) Condition Scale 2 (Excellent).

7.1.2 Fauna of the Mangrove Communities within the City of Salisbury

Mangroves provide habitat for a broad range of fauna, both terrestrial and marine. Table 10 lists data collected from a number of published and unpublished sources for the Mangrove zones within the City of Salisbury.

Table 10 Fauna Data Collected for the Mangrove Areas within the City of Salisbury

Form	Data Collected
Birds	91 species recorded, of which:- • 9 species are protected under international agreements. • 5 species are protected under SA legislation. • 7 species are introduced species.
Reptiles	10 species recorded, of which:- • 9 species are lizards. • 1 snake species recorded.
Mammals	6 native species recorded including 3 bat species.
Marine Invertebrates	29 species recorded
Marine Fish	16 species recorded

18 bird species are breeding in the Mangroves and adjacent Samphires including a colony of 600 *Phalacrocorax varius* (Pied Cormorants) breeding in the Mangroves (Environment Australia 2001).

> This coastal corridor adjoins the Barker Inlet from St Kilda in the north to the North Arm Creek in the south. These wetlands provide a good example of extensive Mangrove and saltmarsh cummunities in the Gulf St Vincent and are listed as nationally important wetlands (Environment Australia 2001).

7.2 Samphires

The Samphire communities occur on inter-tidal and supra-tidal, saline flats and on near-coastal, stranded salt scalds immediately inland of the coastal *Avicennia marina* (Mangrove) low woodlands. Moderate to high soil salinity severely limits the range of both native and exotic plant species able to grow here.

Kraehenbuehl (1996) originally describes this zone as tidal flats with mixed *Halosarcia sp.* (Samphire), *Tecticornia sp. (syn. Sclerostegia sp.)* (Samphire) *Atriplex paludosa* (Marsh Saltbush) *Sarcocornia sp.* (Samphire) low shrublands growing on estuarine mud and sands.

His map shows that in pre-European times, this vegetation association extending one to two kilometres inland from the eastern edge of the Barker Inlet Mangroves covering the present day extent of the Cheetham Saltfields and much of the Bolivar Waste Water Treatment Plant (WWTP) site. (See Figure 3).

Establishment of these 2 enterprises and the erection of sea walls/ levees have resulted in loss or alteration of significant areas of Samphires. Current extent of Samphire communities within the City of Salisbury is shown in Figure 4.

Samphire communities differ in species composition depending on surface elevation, frequency of inundation and isolation from tidal influence. Fotheringham (1994) mapped the various Samphire sub-communities present around Barker Inlet. His classification of Samphire sub-communities along with those of other authorities are presented below.

Plant lists for Samphire Communities within the City of Salisbury based on Vegetation Communities are shown in APPENDIX 2.

An alternative list, based on the distribution of samphire plants for different site locations is presented in APPENDIX 3.

APPENDIX 3, amongst other things, catalogues the native plant species that have recolonised sea walls in and adjacent to the Cheetham Saltfields.

7.0 Coastal Mangrove and Samphire Corridor

7.2.1 Intertidal Samphire Communities

Tecticornia arbuscula (syn. Sclerostegia arbuscula) (Shrubby Samphire) *Sarcocornia quinqueflora* (Beaded Samphire) Dense Low Heaths. These occur in intertidal areas immediately inland of the *Avicennia marina ssp.* marina (Mangrove) woodland where daily tidal inundation results in the exclusion of most weeds and most other local native species. In general, *Tecticornia arbuscula (syn. Sclerostegia arbuscula)* (Shrubby Samphire) forms a sparse to mid-dense upper stratum layer overlying a mid dense to dense ground stratum predominated by *Sarcocornia quinqueflora* (Beaded Samphire). *Wilsonia humilis var. humilis* (Silky Wilsonia), *Samolus repens* (Creeping Brookweed), *Suaeda australis* (Austral Seablite) and *Frankenia pauciflora* (Southern Sea-heath) also frequently occur within this community.

This vegetation community is under threat as landward migration of Mangroves displaces the remaining intertidal Samphire communities (Fotheringham 1994, Coleman 1998).

7.2.2 Supra-tidal Samphire Communities

A number of supra-tidal communities occur within the City of Salisbury. Each occupies a relatively small territory.

7.2.2.1 *Maireana oppositifolia* (Salt Bluebush) Dense Low Heath to Open Dwarf Scrub.

These occur on slightly elevated soils that are infrequently inundated by tides. *Tecticornia arbuscula (syn. Sclerostegia arbuscula)* (Shrubby Samphire), *Halosarcia indica* (Brown-head Samphire), *Lawrencia squamata* (Thorny Lawrencia) are sub-dominant while *Wilsonia humilis var. humilis* (Silky Wilsonia), *Sarcocornia blackiana* (Thick-head Samphire), *Suaeda australis* (Austral Seablite) and *Frankenia pauciflora* (Southern Sea-heath) are often encountered within this community.

> The Barker Inlet Mangroves are zoned as Metropolitan Open Space. Furthermore, all remnant native vegetation including Mangroves and Samphires found west of Port Wakefield Road is protected under the Native Vegetation Act 1991 (SA)

7.2.2.2 *Atriplex paludosa* (Marsh Saltbush) Dwarf to Open Dwarf Scrub.

These occur on slightly elevated soils above the reach of daily tidal influence but within the reach of the occasional storm assisted tide. Within the City of Salisbury it occurs near the outlet of the Little Para River.

Atriplex paludosa (Marsh Saltbush) forms a sparse to very sparse upper stratum over *Lawrencia squamata* (Thorny Lawrencia), *Maireana oppositifolia* (Salt Bluebush) and *Tecticornia arbuscula (syn. Sclerostegia arbuscula)* (Shrubby Samphire). The ground layer frequently has *Sarcocornia quinqueflora* (Beaded Samphire), *Disphyma crassifolium ssp. clavellatum* (Round-leaf Pigface) and *Frankenia pauciflora* (Southern Sea-heath).

7.2.2.3 *Tecticornia halocnemoides ssp. halocnemoides* (Grey Samphire) */ Tecticornia flabelliformis* (Bead Samphire) Low Heath to Open Dwarf Scrub

Note: These two species have recently had their names changed. Former names for these two species were *Halosarcia halocnemoides ssp. halocnemoides* (Grey Samphire) and *Halosarcia flabelliformis* (Bead Samphire) respectively.

These species formed a distinct community along the edges of salt scalds immediately north and south of St Kilda. While *Tecticornia halocnemoides ssp. halocnemoides* (Grey Samphire) is widespread, *Tecticornia flabelliformis* (Bead Samphire) occurs in disjunct pockets.

Both species occur with or without each other. Where they occur together, *Tecticornia halocnemoides ssp. halocnemoides* (Grey Samphire) forms the overstorey. P. Coleman (pers. com. Feb 09) considers that the population of *Tecticornia flabelliformis* (Bead Samphire) south of St Kilda has recently become extinct.

7.2.3 Stranded Supratidal Samphire Communities

These are Samphire communities separated from tidal influence as a result of disturbance from land reclamation. Communities listed below occur on private land.

7.2.3.1 *Halosarcia sp.* (Samphire), *Suaeda australis* (Austral Seablite) *Sarcocornia sp.* (Samphire) Sparse to Dense Low Shrublands

These occupy approximately 46% of the Explosives Magazines site at Dry Creek (Coleman & Cook 2003). A plant species list for this association is not available. However a list of all native plant species compiled by Coleman & Cook (2003) for the entire Explosives Magazines site is presented in APPENDIX 2.

7.2.3.2 *Sarcocornia sp.* (Samphire) *Tecticornia sp. (syn. Sclerostegia sp.)* (Samphire) *Suaeda australis* (Austral Seablite) *Halosarcia sp.* (Samphire) Low Shrubland

These occupy several large areas within Bolivar WWTP (Berkinshaw 2004c, Smith & Brewer. undated). A plant species list for this association is not available.

7.2.3.3 *Atriplex paludosa* (Marsh Saltbush) *+/- Halosarcia sp.* (Samphire) Low Shrubland

This vegetation association occupies 60ha of the St Kilda Antenna Fields site owned by the Department of Defence. EBS (2007) report that the vegetation condition varies from moderate to poor depending on plant density. Condition deteriorates with reduction in vegetation cover, resulting in increased weed density. A list of all native plant species compiled by EBS for the St Kilda Antenna Fields site is presented in APPENDIX 2.

7.0 Coastal Mangrove and Samphire Corridor

7.2.3.4 *Halosarcia pergranulata* (Black-seed Samphire)*+/- Atriplex paludosa* (Marsh Saltbush) Low Shrubland

Similar to the association listed immediately above but with a reversal of dominant species, this association occupies about 58 ha of the St Kilda Antenna Fields site (EBS 2007). Here too, vegetation condition was considered to range from moderate to poor.

A list of all native plant species compiled by EBS for the St Kilda Antenna Fields site is presented in APPENDIX 2.

7.2.4 Condition of Samphire Communities

The condition of the various Samphire communities varies from the lower end of Condition Scale 4 (Good) – to Condition Scale 5 (Degraded) using Turners (2001) scale while EBS (2007) rate it as moderate to poor.

7.2.5 Nationally Protected Samphire Species

Tecticornia flabelliformis (syn. Halosarcia flabelliformis) (Bead Samphire) is protected under both Federal and State legislation (EPBC Act 1999 & SA NPWS Act 1972) and is rated Vulnerable for both. Measures should be undertaken to ensure that the populations of *Tecticornia flabelliformis* (Bead Samphire) are protected.

This species occurs along the edges of salt scalds immediately north and south of St Kilda (Fotheringham 1994). However, P. Coleman (pers. com. Feb 09) considers that the population south of St Kilda is now extinct.

7.2.6 Fauna of the Samphire Zones

Data collated for the City of Salisbury shows that for the coastal Samphire zones, including the Cheetham Saltfields, there are 204 bird species recorded of which 22 are protected under State legislation (NPW Act 1972) and 37 protected under international migratory agreements.

In addition there are 2 native mammals, 10 reptiles and 2 frog species recorded. See APPENDICES 4 to 6 for species lists for each location within the City of Salisbury.

18 bird species are breeding on the Samphire flats (and adjacent Mangroves) including Black-winged Stilts *Himantopus himantopus* (Environment Australia 2001).

An icon species for the Samphire communities of the City of Salisbury is *Acanthiza iredalei rosinae* (Slender-billed Thornbill) rated Vulnerable for SA (NPW Act 1972). Within the Cities of Port Adelaide Enfield and Salisbury, the former range of this species extended round the entire Barker Inlet as far west as North Haven.

Today the species no longer occurs south of St Kilda. Loss or degradation of the Samphire habitat is thought to be responsible (John Cox pers. com. Feb 09).

7.3 Threats to Samphire Communities

Primary threats to Samphire communities include recreational activities (trail bikes etc), rubbish dumping and the community perception that tidal saltmarsh/samphire communities are simply wasteland (Turner 2001).

Secondary threats include landward migration of Mangrove communities into samphire flats as a result of sea level rise due to climate change. This migration is likely to result in the displacement of the samphire communities as the latter are unable to migrate further inland into the salt fields. Samphire dependent bird species such as *Acanthiza iredalei rosinae* (Slender-billed Thornbill) and *Himantopus himantopus* (Black-winged Stilts) which commonly breed on samphire flats may be displaced as a result.

> “Primary threats to Samphire communities include recreational activities (trail bikes etc), rubbish dumping and the community perception that tidal saltmarsh/samphire communities are simply wasteland (Turner 2001).”

7.4 Samphire Management

The City of Salisbury, in keeping with Strategy 6.4 of the Game Plan (2008) is partnering with the Urban Biodiversity Unit of DEH, to revegetate the Samphire zone of the Little Para River Estuary in accordance with a management plan by Berkinshaw (2004).

The City of Salisbury also manages the Mangroves and adjacent Samphires along the St Kilda Mangrove Boardwalk area.

Several private landowners have revegetation and management plans for their sites containing remnant Samphire zones.

These are:

- SA Water for Bolivar Waste Water Treatment Plant (WWTP)
- Department of Defence for St Kilda Antenna Fields site.

The remainder of the Samphire and Mangrove areas are under the control of the Cheetham Saltfields and the Land Management Corporation (LMC).

7.5 Opportunities for Biodiversity Enhancement

The City of Salisbury's Game Plan (2008) Strategy 5 requires that the future ecological health and natural biodiversity of the Barker Inlet (which includes the Coastal Mangrove and Samphire Corridor) is ensured.

Currently the City of Salisbury is undertaking a strategic planning exercise for land west of Port Wakefield Road including the Coastal Mangrove and Samphire Corridor to conserve biodiversity in these areas, particularly with regard to shorebirds, shorebird habitat and the possible impacts of relative sea-level rise.

Consequently there is partnership with the taskforce developing the AMLR NRM Board Shorebird Discussion Paper.

While much of the land is privately controlled, the following measures can still be taken with the co-operation of the landholders:

- Protect plants of conservation significance and their habitats. Listed species include *Tecticornia flabelliformis (syn. Halosarcia flabelliformis)* (Bead Samphire) rated Vulnerable nationally (EPBC Act 1999) and *Centrolepis cephaloformis ssp. cephaloformis* (Cushion Centrolepis) rated Rare for SA (NPW Act 1972).
- Monitor Mangrove and Samphire migration caused by sea level rise; Create opportunities for the establishment for retreat zones.
- Control serious weed infestations as they occur.
- Protect bird breeding areas.
- Protect and manage the Samphire habitat for bird species such as *Acanthiza iredalei rosinae* (Slender-billed Thornbill) and *Himantopus himantopus* (Black-winged Stilts) which commonly breed on Samphire flats.
- Enter into co-operative agreements with private landholders (e.g. Cheethams, SA Water & Defence etc) to ensure that Mangrove and Samphire zones are managed uniformly over the entire City of Salisbury.

8.0 Little Para River Corridor

The Little Para River is a seasonal creek which originates upstream of the City of Salisbury near Lower Hermitage in the Mount Lofty Ranges. It flows north westwards from its source to the Little Para Reservoir and then westwards through the City of Salisbury to the Barker Inlet of Gulf Saint Vincent at Globe Derby Park.

The Little Para River enters the City of Salisbury's eastern boundary approximately two kilometres upstream of Main North Road and then travels downstream for approximately 10km to Port Wakefield Road. From Port Wakefield Road it flows through a series of constructed wetlands before traversing Samphire flats and Mangroves to the sea.

An environmental flow of water, for aquifer recharge, is released from the Little Para Reservoir by SA Water. The flow passes through Carisbrooke, Harry Bowey and Jenkins Reserves but ceases in private property before reaching Pioneer Park. The remaining ~6km of watercourse is dry during summer.

The Little Para River Corridor is zoned as Metropolitan Open Space. Remnant native vegetation occurring along the Little Para River, upstream of the Main North Road and downstream of Port Wakefield Road is protected under the Native Vegetation Act 1991 (SA). (See definition of the area in the Native Vegetation (Miscellaneous) Amendment Bill 2002.)

8.1 Pre-European Plant Communities

The Little Para River Corridor passed through five vegetation associations during its journey through the City of Salisbury (Kraehenbuehl 1996). These are described below and are mapped in Figure 3.

8.1.1 *Eucalyptus camaldulensis* (River Red Gum) *+/- Eucalyptus leucoxylon* (SA Blue Gum) Woodland

This woodland lines the watercourse for the full length of the Little Para River with *Eucalyptus camaldulensis* (River Red Gum) trees scattered out over the floodplain. Remnant *Eucalyptus leucoxylon* (SA Blue Gum) trees only occur along Little Para River Corridor as one group of five (5) mature trees on the City of Playford's side of Harry Bowey Reserve.

8.1.2 *Austrostipa spp.* (Speargrass), *Austrodanthonia spp.* (Wallaby Grass) Grassland

An *Austrostipa spp.* (Speargrass), *Austrodanthonia spp.* (Wallaby Grass) Grassland formerly abutted the Little Para River Corridor on the:

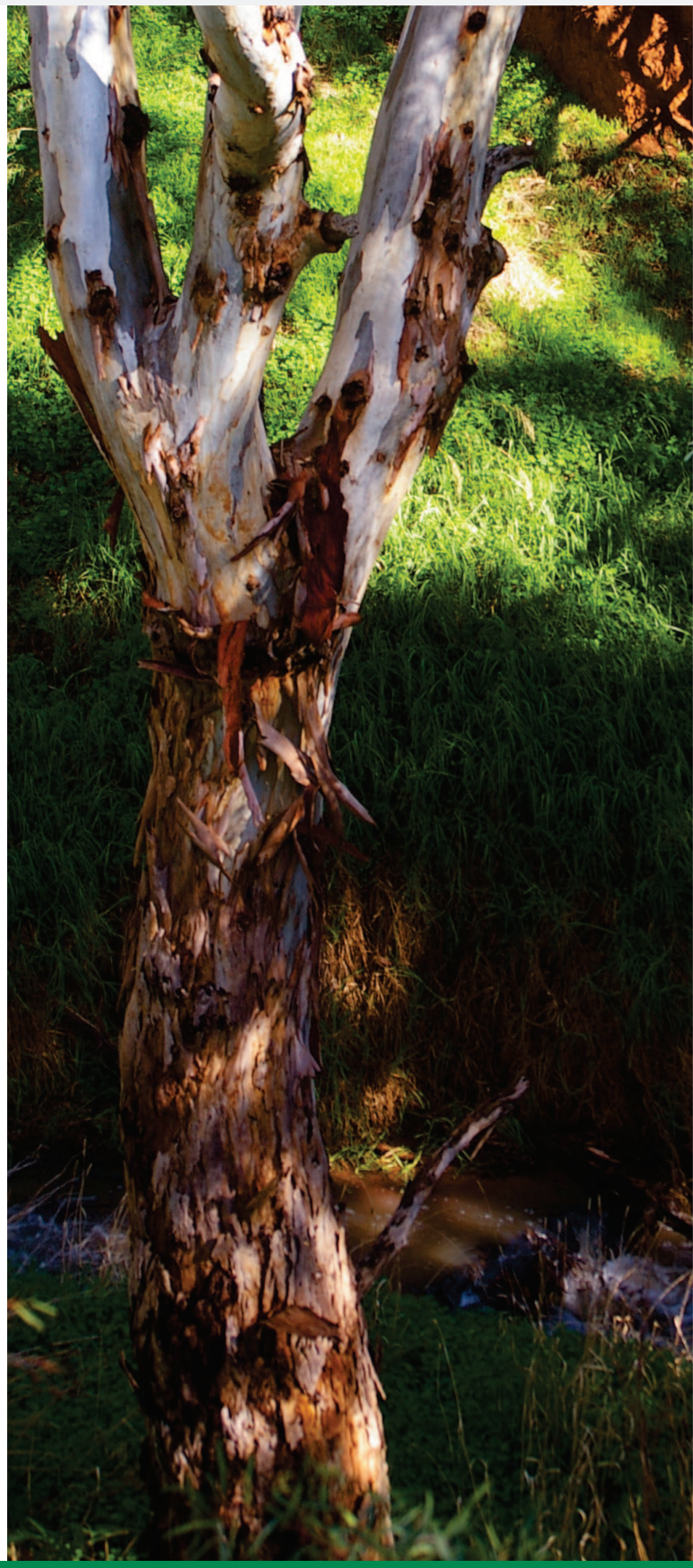
- Northern side between the Samphire coastal zone and Happy Home Reserve.
- Southern side between the coastal Samphire zone and the Para Escarpment.

8.1.3 *Eucalyptus porosa* (Mallee box) Woodland

Eucalyptus porosa (Mallee box) Woodland formerly abutted the Little Para River Corridor on the:

- Northern side upstream of Happy Home Reserve.
- Southern side, east of Main North Road.

> The Little Para River Corridor is zoned as Metropolitan Open Space. Remnant native vegetation occurring along the Little Para River, upstream of the Main North Road and downstream of Port Wakefield Road is protected under the Native Vegetation Act 1991 (SA)



8.1.4 *Mixed Halosarcia sp.* (Samphire), *Sclerostegia sp.* (Samphire) *Atriplex paludosa* (Marsh Saltbush) *Sarcocornia sp.* (Samphire) Low Shrublands

This vegetation association once extended immediately inland of the coastal Avicennia marina (Mangrove) low woodlands on estuarine mud and sands and covered most of the land now occupied by the Cheetham Saltfields. Kraehenbuehl (1996).

8.1.5 *Avicennia marina* (Mangrove) Low Woodlands

The Little Para River flows into Swan Alley Creek which traverses the Mangroves of Barker Inlet.

8.2 Current Remnant Native Vegetation Present

Vegetation has changed dramatically since 1836. The following provides a picture of remnant native vegetation present along various segments of the Little Para River Corridor today.

8.2.1 Little Para Linear Park (Upper)

Upstream of Main North Road, three remnant native vegetation associations occur in a degraded state. These associations are:

- *Eucalyptus camaldulensis* (River Red Gum) Woodland along the watercourse.
- *Eucalyptus porosa* (Mallee Box) Open Woodland on the southern hillslopes.
- *Austrostipa spp.* (Speargrass), *Austrodanthonia spp.* (Wallaby Grass) Grassland in a large area cleared, in part, of its *Eucalyptus porosa* (Mallee Box) woodland upper storey.

A revegetation action plan for this site prepared by EBS (2009) will form the basis for on-ground works.

8.0 Little Para River Corridor

8.2.1.1 *Eucalyptus camaldulensis* (River Red Gum) Woodland along the Watercourse

Eucalyptus camaldulensis (River Red Gum) open forest grows adjacent the low flow channel of the watercourse. Remnant *Eucalyptus leucoxylon* (SA Blue Gum) trees are absent along this segment of the corridor.

Little remnant native riparian vegetation now remains, apart from isolated individuals or occasional thickets of *Acacia salicina* (Willow Wattle). Otherwise, the riparian shrub layer is essentially absent.

The aquatic macrophyte layer consists of extensive reedbeds of *Phragmites australis* (Common Reed) and *Typha domingensis* (Narrow-leaf Bulrush) with a sparse scattering of tussocks of a few other species along the low flow channel.

Native plant species known to occur in this association are listed in APPENDIX 9.

8.2.1.2 *Eucalyptus porosa* (Mallee Box) Open Woodland on the Southern Hillslopes

Remnant *Eucalyptus porosa* (Mallee Box) Open Woodland still occurs in a degraded state along the southern slopes and in the steeper gullies.

Native understorey species are depleted and occur as a sparse scattering amongst the remnant trees. Understorey plant range and density increases in steep, rocky locations which have resisted clearance and grazing by sheep.

Native plant species known to occur in this association are listed in APPENDIX 9.

8.2.1.3 *Austrostipa spp.* (Speargrass), *Austrodanthonia spp.* (Wallaby Grass) Grassland

This vegetation association occurs immediately upstream of the Main North Road. In this location native grass density varies with the soil depth. Locations with shallow, stony soils have a high density of native grasses and low weed density. The reverse is true where soils are deeper.

Enneapogon nigricans (Black-head Grass), *Aristida behriana* (Brush Wire-grass) and a number of species of *Austrostipa sp.* (Spear-grass) dominate this grassland. *Bothriochloa macra* (Red-leg Grass) rated Rare for SA (NPW Act 1972) occurs in a number of patches. Scattered amongst the native grasses are a number of small, native herbs and forbs; most of these are considered to be disturbance resistant.

Native plant species known to occur in this association are listed in APPENDIX 9.

8.2.2 Little Para River Corridor between Main North Road and Port Wakefield Road

Native Vegetation has been cleared in the past resulting in a parkland setting. Of the original 177 native plant species originally present according to Kraehenbuehl (1997) only 23 species were found; most in low numbers.

Visually, this landscape consists of tall trees over mown turf or slashed grasses. The trees are clustered densely along the watercourse and within some plantations and the remainder are scattered sparsely throughout the parklands. Generally, trees rarely occur beneath the high tension powerlines which also share the same corridor as the watercourse.

High public use areas such as Carisbrooke Reserve, Harry Bowey Reserve, Jenkins Reserve, Pitman Park, Happy Home Reserve and the Little River Golf Course have irrigated turf areas; elsewhere the ground layer is a cover of slashed exotic grasses and weeds with the occasional disturbance-resistant native grass or herb present.

“Most Eucalyptus trees along the watercourse qualify as significant trees under the Development Act 1993 (SA). A number of these older trees contain tree hollows that provide habitat for possums, bats and birds.”

From a public surveillance point of view, there is little cover for undesirable behaviour as the entire corridor is readily visible from all pathways.

The watercourse itself is lined with an open forest. The dominant species is *Eucalyptus camaldulensis* (River Red Gum) which occurs as a mix of ancient and newer trees. Present in places are isolated individuals or thickets of *Acacia salicina* (Willow Wattle).

Remnant *Eucalyptus leucoxylon* (SA Blue Gum) trees are essentially absent from this corridor except for a small group of five ancient trees at Harry Bowey Reserve, on the City of Playford side of the Watercourse.

Most Eucalyptus trees along the watercourse qualify as significant trees under the Development Act 1993 (SA). A number of these older trees contain tree hollows that provide habitat for possums, bats and birds. However natural recruitment of *Eucalyptus camaldulensis* (River Red Gum) is occurring in some locations with seedlings, saplings and semi-mature trees present in places along or adjacent to the watercourse.

Native shrubs rarely occur and even aquatic macrophytes are encountered infrequently. For most of the length of the corridor, the low-flow channel is narrow (<2m) with steep sides, adapted for rapid water drainage. Unfortunately this rapid water movement prohibits the establishment of aquatic macrophyte species thereby minimising both the range of native plant species and also the habitats that such plants could offer.

Four remnant and very old *Eucalyptus porosa* (Mallee box) still occur adjacent the entryway to Harry Bowey Reserve, Salisbury Park on the southern side of the watercourse.

Upstream of the Stanley Avenue Reserve, where an environmental flow of water occurs, a small range of aquatic herbs grow in the saturated soil along the water's edge. These include *Persicaria decipiens* (Slender Knotweed), *Crassula helmsii* (Swamp Crassula) and a few plants of *Lythrum salicaria* (Purple Loosestrife); the latter is rated Rare for SA under the NPW Act 1972. In addition, a small population of the submerged aquatic plant *Vallisneria americana var. americana* (River Eel-grass) occurs in Carisbrooke Park. This is possibly the last remnant population of this species on the Adelaide Plains.

Downstream of Stanley Avenue Reserve, no aquatic herbs or submerged plants were found as the watercourse was totally dry during summer.

Where the watercourse passes through two private land holdings (one on each side of the Stanley Avenue Reserve) it has an almost impenetrable barrier of *Arundo donax* (Yellow Bamboo or Giant Reed) lining both sides of the watercourse beneath ancient *Eucalyptus camaldulensis* (River Red Gum) trees.

A combination of past vegetation clearance, heavy shade from overhead trees and present management regimes have contributed to significant species loss and prevented the re-establishment of most riparian and aquatic macrophyte species.

APPENDIX 10 summarises the remnant native plant species recorded during a brief reconnaissance survey undertaken during October 2008. The tally of native species does slightly exceed that recorded in Turner (2001) but it is far from the number reported in Kraehenbuehl (1997).

8.2.2.1 Overflow Corridor

Splitting off from the Little Para River Corridor is the Overflow Corridor at Paralowi.e. This is essentially a broad, shallow, trapezoid drain which enters Overflow Reserve and passed through Tabitha Avenue Reserve, Fairbanks Drive Reserve, McQueen Court Reserve, Ronaldo Way Reserve and Bolivia Crescent before crossing Port Wakefield Road to the Bolivar Waste Water Treatment Plant site. This overflow corridor is maintained as a slashed weedland with occasional edge plantings of trees and shrubs.

A small number of local native grasses and herbs have colonised this corridor. Of interest is the presence of many plants of *Sclerolaena muricata var. villosa* (Five-spine Bindyi) which is rated Rare under the SA NPWS Act (1972). This thorny annual or biennial plant occurs on north-facing batters of Bolivia Crescent Reserve. It survives the slashing regime and its seeds seem to be spread by the slasher.

8.0 Little Para River Corridor

8.2.3 Little Para River Corridor Downstream of Port Wakefield Road

Downstream of Port Wakefield Road, the Little Para River passes through a series of large constructed wetlands (locally referred to as the Little Para Estuary Wetlands and Whites Road Wetlands) for final water cleansing before entering the Little Para estuary through a constructed channel. The Little Para Estuary is a samphire zone subject to revegetation efforts by SA Urban Biodiversity Unit of DEH (Geoff Booth pers com) in accordance to a management plan by Berkinshaw (2004b). APPENDIX 11 lists the species planted at the Little Para Estuary wetlands while APPENDIX 12 lists native plant species occurring in the Little Para Estuary Samphire zone – where revegetation is also occurring.

8.3 Condition of Vegetation Communities along the Little Para River Corridor Today

The City of Salisbury City Landscape Plan (Hassell, 2007 p34) describes the Little Para River Corridor as severely degraded. Table 11 summarises the current condition of the remnant vegetation associations using the Turner (2001) scale.

Table 11 Summary of the Current Condition of the Vegetation Associations along the Little Para River- after Turner (2001)

Vegetation Association Along and Adjacent The Little Para River Corridor	Turner (2001) Condition Scale
Eucalyptus camaldulensis (River Red Gum) +/- *Eucalyptus leucoxylon* (SA Blue Gum) Woodland along the Watercourse	Scale 5 (Degraded)
Austrostipa spp. (Speargrass), *Austrodanthonia spp.* (Wallaby Grass) Grassland	Scale 6 (Completely Degraded)
Austrostipa spp. (Speargrass), *Austrodanthonia spp.* (Wallaby Grass) Grassland Large patch upstream of Old Spot Hotel	Scale 4 (Good)
Eucalyptus porosa (Mallee box) Woodland	Scale 5 (Degraded)
Mixed Halosarcia sp. (Samphire), *Sclerostegia sp.* (Samphire) *Atriplex paludosa* (Marsh Saltbush) *Sarcocornia sp.* (Samphire) Low Shrublands	Scale 4 (Good) to Scale 5 (Degraded)
Avicennia marina (Mangrove) Low Woodlands	Scale 2 (Excellent)

> Downstream of Port Wakefield Road, the Little Para River passes through a series of large constructed wetlands (locally referred to as the Little Para Estuary Wetlands and Whites Road Wetlands) for final water cleansing before entering the Little Para estuary through a constructed channel.

NOTE: Degraded landscapes are generally characterised by low species diversity, low structural complexity, abundance of weeds and a high risk of degradation from the surrounding landscape.

8.4 Past Revegetation Efforts along the Little Para River Corridor

A number of localised revegetation plantings have occurred in the past along the Little Para River Corridor between Port Wakefield Road and Main North Road.

Generally these planting consisted of isolated plants or massed groups and were provided for shade, windbreak or fence line screening. They were not intended to recreate the former vegetation association on site.

APPENDIX 13 lists the native plant species used in these revegetation efforts along the Little Para River Corridor between Port Wakefield Road and Main North Road.

In some cases, exotic tree species were planted, including **Tamarix parviflora* (Athel Pine), **Pinus halepensis* (Aleppo Pine) and **Schinus molle* (Pepper-tree).

A recent revegetation effort immediately upstream of Main North Road has used local provenance tree, shrub and groundcover species in an attempt to recreate a section of *Eucalyptus porosa* (Mallee box) woodland. Native plant species used in the revegetation works here are listed in APPENDIX 14.

Most species planted are appropriate for the northern Adelaide Plains.

8.5 Significant Pest Plants along the Little Para River Corridor

Good management by Asset Services landscape management staff of the City of Salisbury has resulted in low frequency of pest plants along the Little Para River Corridor. However, pest plants still do occur in pockets, usually where access is difficult. Some pest plants are not recognised as such and are consequently left to grow and spread.

These include **Acacia saligna* (Golden Wreath Wattle), **Casuarina glauca* (Grey Buloak), **Pinus halepensis* (Aleppo Pine) and **Pennisetum clandestinum* (Kikuyu).

The area of highest pest plant concentration is along the edge of the low flow channel of the watercourse where dense **Pennisetum clandestinum* (Kikuyu) protects and harbours other pest species such as **Allium triquetrum* (Three-cornered Garlic). It also smothers the low flow channel preventing the self regeneration of aquatic macrophytes and herbs.

No Weeds of National Significance were found on the site. However a number of species proclaimed for South Australia under the Natural Resources Management Act 2004 occurred.

Priority Environmental Weeds found on site are listed in APPENDIX 15.

8.6 Key Threats and Management Issues

Disturbances

- Watercourse is smothered by **Pennisetum clandestinum* (Kikuyu) which prevents establishment of most aquatic vegetation.
- Dense barrier of **Arundo donax* (common Reed) along watercourse in private land holdings.
- Narrow, deeply incised low-flow channel which offers no suitable planting locations for aquatic macrophytes.
- Dumping of rubbish in watercourse
- Feral bee hives occupying some tree hollows to the exclusion of native fauna.

Management Issues

- Ensuring casual surveillance of sites is possible while re-establishing natural-looking remnant native associations along the corridor.

8.0 Little Para River Corridor

8.7 Fauna along the Little Para River Corridor

When compared to 1836, the fauna populations today have altered dramatically as a direct result of habitat loss and alteration with considerable loss of species. Fauna data collection for the Little Para River Corridor is mostly based on anecdotal evidence rather than surveys and is therefore likely to contain some inaccuracies and be incomplete. Current information is recorded in Table 12.

Table 12 Fauna Data Collected for the Little Para River Corridor

Form	Data Collected
Birds	76 species recorded, of which:- • 3 species are protected under international agreements. • 4 species are protected under SA legislation (NPW Act 1972). • 7 species are introduced species. See APPENDIX 16 for full lists.
Reptiles	9 species recorded, of which:- • 1 species is nationally protected (EPBC Act 1999) • 7 species are lizards. • 1 species is a snake. • 1 species is an introduced tortoise. See APPENDIX 17 for full lists.
Amphibians	4 frog species are recorded. See APPENDIX 17 for full lists.
Mammals	8 species are recorded including 3 bat species. See APPENDIX 18 for full list.
Aquatic Invertebrates	46 species recorded at various points along the watercourse See APPENDIX 19 for full list.
Native Fish	4 fish species recorded at the estuary wetlands. See APPENDIX 20 for full list.

APPENDICES 16 to 20 provide full lists of all species known to occur along the Little Para River Corridor including occurrences of birds, reptiles, amphibians, mammals and aquatic invertebrates and native fish.

Aquatic invertebrate data collected by Waterwatch (see APPENDIX 19) indicates that water quality is good in the Little Para Linear Park (Upper) Zone (upstream of Main North Road) and relatively good at the Little Para River Estuary Wetlands. However, the watercourse in between (when it is flowing) has poorer water quality.

8.7.1 Nationally Protected Species

Aprasia pseudopulchella (Flinders Ranges Worm-lizard) is protected under Federal (EPBC Act 1999) legislation and is rated Vulnerable. However, it is does not hace a conservation rating under state legislation (SA NPWS Act 1972).

Aprasia pseudopulchella (Flinders Ranges Worm-lizard) has been recorded in the Little Para Linear Park (Upper) zone, upstream of Main North Road. (PJ Matejcic (SA Herp. Group) unpublished data). This species is also recorded in the nearby Cobbler Creek Recreation Park (EPBC Website - accessed Feb 09).

Aprasia pseudopulchella (Flinders Ranges Worm-lizard) occurs in open woodland, native tussock grassland, riparian habitats and under isolated rocks. It prefers stony soils or clay soils with a stony surface, and has been found sheltering in soil beneath stones and rotting stumps (EPBC Website - accessed Feb 09).

In the Little Para Linear Park (Upper) zone this type of habitat occurs in the steep sided gullies. Southern gullies are partly owned by the City of Salisbury and partly by a number of private landholders.

Measures should be undertaken to ensure that the populations of Aprasia pseudopulchella (Flinders Ranges Worm-lizard) are conserved. This includes the conservation on remaining habitat within the reserve and adjacent private land holdings.

Necessary actions include active bush care of the habitat sites to manage weeds and feral animals. Where the grass and herb layer is absent or sparse, revegetation should occur using direct seeding and/or tubestock plantings.

> In order to secure the botanical diversity along the corridor it is necessary to increase plant numbers for species currently present in low numbers and to reinstate a range of other species now locally extinct along the watercourse and adjacent parkland.

8.7.2 State Protected Species

Four bird species, protected under the SA NPWS Act (1972), have been recorded along the Little Para River Corridor. The first 3 species listed below, were recorded at the Little Para River Estuary Wetlands while the fourth has been observed in tall trees at several locations, including Kaurna Park Wetland and Carisbrooke Park. (J Cox pers. com.). Protected species are:

- *Anas rhynchotis* (Australasian Shoveler) rated Rare for SA.
- *Haliaeetus leucogaster* (White-bellied Sea-eagle) rated Vulnerable for SA.
- *Oxyura australis* (Blue-billed Duck) rated Rare for SA.
- *Melithreptus gularis gularis* (Black-chinned Honeyeater) rated Vulnerable for SA.

8.8 Opportunities for Biodiversity Enhancement

The City of Salisbury City Landscape Plan (2007 p34) recommended the reinstatement of the River Redgum plant communities along the watercourse and revegetation of the river banks.

Opportunities for biodiversity enhancement along the Little Para River Corridor are listed as follows:

- Re-establish reed beds along the watercourse for water cleansing and bird habitat.

  Creating occasional open pools of permanent water along the watercourse to provide aquatic habitat; drinking water for water-dependent birds; summer refuges for fish, yabbies and frogs and habitat for water birds.

- Plant riparian vegetation beneath the *Eucalyptus camaldulensis* (River Red Gum) trees adjacent the watercourse. This will also provide wildlife habitat for target fauna species (eg small wrens).

- Establish native grasslands in open areas adjacent pathways. This low vegetation will allow safe public movement along the corridor by allowing passive surveillance along pathways.

- Plant sufficient local-provenance *Eucalyptus leucoxylon ssp. leucoxylon* (South Australian Blue Gum) trees along the corridor to create a final canopy cover (at maturity) of 30%. This will provide significant food and habitat resources for the Vulnerable (SA NPW Act 1972) Black-chinned Honeyeater *(Melithreptus gularis gularis)* which is sparsely present within the City of Salisbury along the Little Para River Corridor and at Kaurna Park Wetland.

- Buffer the four old remnant trees of *Eucalyptus porosa* (Mallee Box) present near the entrance to Harry Bowey Reserve by planting around them to create a pocket of a *Eucalyptus porosa* (Mallee Box) Open Woodland.

- Provide 'natural looking' nesting boxes, rock piles, fallen logs etc for additional microhabitat diversity in selected locations.

- Develop partnerships with the Cities of Playford and Tea Tree Gully so that an agreed approach is used by each council to revegetate and manage the segments of Little Para River Corridor owned by them.

8.8.1 General Comments

In order to secure the botanical diversity along the corridor it is necessary to increase plant numbers for species currently present in low numbers and to reinstate a range of other species now locally extinct along the watercourse and adjacent parkland. Revegetation should preferably be undertaken to re-establish the various pre-European vegetation associations formerly present along the Corridor. An equally important purpose for revegetation along the Little Para River Corridor is the re-establishment of habitat and safe movement pathways for locally disadvantaged fauna species.

Revegetation adjacent the Little Para Linear Trail and local residences, in high public use areas should also be visually pleasing. Use of mulched, dense, single species plantings of attractive, local-native species adds to the visual amenity of these sites. Such plantings can also double as suitable habitat for identified locally disadvantaged fauna species.

Site specific revegetation and management plans should be drawn up prior to commencement of works.

8.0 Little Para River Corridor

8.8.2 Public Safety Constraints on Revegetation

As stated earlier, the need for public safety must be a high priority. This is practically achieved by ensuring that unobstructed views are available along pathways to allow for visual surveillance. However, along the Little Para River Corridor, pathways generally occur atop low levees constructed at a distance from the watercourse. Only occasionally do pathways pass adjacent to or cross over the watercourse. It is recommended that any revegetation undertaken within 10m of pathways be limited to low-lying plantings or high branching trees to allow good surveillance.

Wherever practicable, reconstruction of native grasslands adjacent public pathways in unirrigated areas is recommended as these will reinstate numerous native grass and herb species while allowing unobstructed views for public safety. Dense shrub plantings should be undertaken at a distance from pathways such as adjacent the watercourse only. Where pathways run in close proximity to the watercourse, dense shrubs should only be planted on the opposite side of the watercourse.

8.8.3 Creating a Blue Wren Corridor

Reinstatement of fauna habitat is a priority. In its current state, the Little Para River Corridor favours larger birds such as *Gymnorhina tibicen* (Magpies), *Corvus mellori* (Little Raven), *Eolophus roseicapillus* (Galah) and the more aggressive nectar feeding birds such *Manorina melanocephala* (Noisy Miners) and *Trichoglossus haematodus* (Rainbow Lorikeets).

Small, insectivorous birds (such as wrens) are most disadvantaged along the Little Para River Corridor through lack of sufficient food resources, safe refuges and aggressive behaviour of larger birds. These small, insectivorous birds require a dense, shrubby mid storey and understorey in which to shelter and forage (Parsons 2007).

This habitat type occurs too sparsely or is too widely spaced along the Little Para River Corridor for the small birds to safely migrate from one location to another.

> Small, insectivorous birds (such as wrens) are most disadvantaged along the Little Para River Corridor through lack of sufficient food resources, safe refuges and aggressive behaviour of larger birds.

Opportunity exists to plant a dense low to mid stratum shrub layer beneath the canopy of the *Eucalyptus camaldulensis* (River Red Gum) trees which line the watercourse, and to fill in tight river bends with this type of vegetation.

Within a few years, this will provide shelter, habitat and a movement corridor for small, insectivorous bird species such as *Malurus cyaneus* (Superb Fairy-wren or Blue Wren). This local icon species currently occurs at either end of the Little Para River Corridor, (ie both in the Little Para River Estuary and in the Little Para River (Upper) area) but has disappeared in the urban section of the corridor.

Creation of a Blue Wren corridor along the length of the Little Para River is achievable. This requires clusters of dense shrubby bushes to be planted at intervals not exceeding 50m as these birds shelter and nest in dense shrubbery (Stevens 2008).

These dense plantings will have a secondary effect of diminishing the negative effects of *Manorina melanocephala* (Noisy Miner) and other aggressive birds dominance along the corridor by breaking up their line of sight.

8.8.4 Proposed Recovery Plan for the Black-chinned Honeyeater *(Melithreptus gularis gularis)*

This bird is sparsely present within the City of Salisbury along the Little Para River Corridor (J Cox pers. com.). It is listed as Vulnerable in SA (NPW Act 1972) and considered near Threatened at the national level (Garnett and Crowley 2000).

Black-chinned Honeyeaters usually forage in large eucalypts in the upper canopy on the outermost flowers and foliage. They feed mainly on insects, nectar and lerps (sap sucking insects which form a sugary outer covering) from eucalypt foliage and bark (Blakers et al. 1984), but will sometimes eat seeds.

They move in response to the flowering cycles of their food plants and the availability of insects, their primary food source (City of Onkaparinga website). The species does not persist in remnants less than 200 ha in area. (NSW Scientific Committee 2001).

It is intended to expand the size of the *Eucalyptus camaldulensis* (River Redgum) +/- Eucalyptus leucoxylon (SA Blue Gum) woodland along the Little Para Corridor to a size greater than 200 hectares in order to allow sufficient resources for a stable population of the Black-chinned Honeyeater to persist (NSW Scientific Committee 2001).

To achieve this, it is intended to add more of each of the dominant trees of this association within the corridor, with a weighting towards *Eucalyptus leucoxylon* (SA Blue Gum) in order to extend the availability of nectar from 3 months to 9 months of the year; i.e. *Eucalyptus camaldulensis* (River Redgum) mainly flower throughout summer while *Eucalyptus leucoxylon* (SA Blue Gum) mainly flower during autumn and winter.

The two species together will provide nectar for >9 months of the year and insects for the entire year. The combination of old trees and younger trees in proximity to one another will satisfy the Black-chinned Honeyeater's favoured habitat preference for a mixture of mature and regenerating woodland Eucalypts (Willson & Bignall 2009).

A more detailed account of this recovery plan is presented in APPENDIX 58.

8.8.5 Creating Habitat for Other Fauna

Native fauna species with specific habitat needs must also be catered for. This will entail the provision and thoughtful placement of:

- "Natural looking" nesting boxes for possums, bats and parrots.
- Tussocky grassland pockets for lizard habitat.
- Fallen logs or rock piles in suitable locations for lizard habitat.
- Deep water pools to provide refuges for native fish, yabbies and frogs during summer drought.

If designed correctly, these features should be relatively safe for the public.

8.0 Little Para River Corridor

8.8.6 *Eucalyptus camaldulensis* (River Red Gum) *+/- Eucalyptus leucoxylon* (SA Blue Gum) Woodland Rehabilitation

Figure 5 shows possible locations where this vegetation association may be reinstated by adding the missing terrestrial and aquatic understorey plantings.

Erosion control and weed control should precede any revegetation efforts along the watercourse. Removal of the dense thatch of **Pennisetum clandestinum* (Kikuyu) along and adjacent the low flow channel is essential as this pest plant will smother any revegetation planted in this zone. Only herbicides approved for use along watercourses should be used e.g. Weedmaster Duo®, Roundup Biactive® or similar.

Vegetation restoration is recommended for the watercourse aquatic environment and the adjacent riparian zone to reinstate *Eucalyptus camaldulensis* (River Red Gum) *+/-Eucalyptus leucoxylon* (SA Blue Gum) Woodland configured to provide wildlife habitat for target fauna species (eg small wrens and the Black-chinned Honeyeater).

Where an environmental water flow is available along the Little Para River Corridor (currently from the Council's eastern boundary to Stanley Avenue Reserve), opportunity exists to restore a broad range of emergent and submerged aquatic macrophyte species and aquatic herbs within and immediately adjacent to the low-flow channel.

Downstream of Stanley Avenue Reserve where no water flow is available between rain events, drought intolerant species will not survive. However, there is still opportunity to plant the edges of the low flow channel with drought-tolerant tussocky and spreading macrophyte species such as *Carex bichenoviana* (Notched Sedge), *Cyperus gymnocaulos* (Spiny Flat-sedge), *Eragrostis infecunda* (Barren Cane-grass) and *Gahnia filum* (Thatching Grass).

The riparian zone can be similarly landscaped using drought tolerant riparian shrubs and trees downstream of Stanley Avenue Reserve, and water loving shrubs and trees upstream where permanent water is available.

Landscaping should contain a broad range of plant species as these are more likely to support a broad range of bird species. Plants should be placed in single-species clumps of at least 5-7 so there is enough of the resource (food or shelter) available to be used by the birds. Mass plantings of different plant species is also better for overall aesthetics and design (Birds in Backyards Website – Guidelines for Councils and Planners- viewed Feb 09).

Native riparian species suitable for introduction along the watercourse either within the low flow channel or immediately adjacent to it are listed in APPENDIX 21.

8.8.7 Grassland Restoration

Large open areas of slashed weedland occur between the pathways/levees and the watercourse. This is also true of the overflow corridor passing through Paralowi.e. Opportunity exists to convert some of these areas into native grasslands with their attendant native herbs and groundcovers using cost-effective, broadacre, direct seeding techniques.

Once direct seeded plants are established, additional low species can be added using tubestock. Figure 5 shows possible locations where this vegetation association may be reinstated.

Designated native grassland areas will require their own management programme as indiscriminate slashing will damage the grasses and groundcovers. Recommended species for native grasslands along the Little Para River Corridor are listed in APPENDIX 22.

It is also proposed to plant about 40 *Eucalyptus leucoxylon ssp. leucoxylon* (SA Blue Gum) trees per hectare throughout the grasslands. These trees will provide a final canopy cover of 30% at maturity in order to offer significant food and habitat resources for the Vulnerable (SA NPW Act 1972) Black-chinned Honeyeater *(Melithreptus gularis gularis)* which is sparsely present along the Little Para River.

Potential exists to add some visually striking native plants into the reconstructed native grasslands such as *Xanthorrhoea quadrangulata* (Yacca) and *Lomandras* (Mat-rushes). These should be placed in dedicated, mulched plots where they will not be slashed.

> The aim is to create a carpet of low native species to cover the soil and keep out weeds. Once this is established (ie several years later) cell or tubestock-grown, mid storey and overstorey species are added to complete the vegetation association.

8.8.8 *Eucalyptus porosa* Open Woodland Restoration

One location adjacent the entrance to Harry Bowey Reserve, may potentially be revegetated as *Eucalyptus porosa* (Mallee Box) Open Woodland to buffer the four ancient trees of this species already present. Figure 5 shows the suggested extent of restoring this vegetation association.

The method of revegetation will determine the species used. If work is done using the direct seeding method, then the understorey species are planted first.

Here the aim is to create a carpet of low native species to cover the soil and keep out weeds. Once this is established (ie several years later) cell or tubestock-grown, mid storey and overstorey species are added to complete the vegetation association.

This revegetation method is a relatively recent innovation and is reliant on adequate site preparation with weed control preceding initial seeding by 1 to 2 years.

However, if the site is planted primarily using tubestock, then overstorey and midstorey species are planted with only a small selection of groundcovers.

Most of the native grasses and forbs are not used. Here the aim is to create a heavy foliage canopy to shade out weeds. Unfortunately the shade also prevents the establishment of many of the ground layer species.

This has been the traditional revegetation method used for the past 30 years or more. Modification of this method is needed to ensure a more balanced habitat outcome.

APPENDIX 23 lists species that are suitable for planting in a *Eucalyptus porosa* (Mallee Box) Open Woodlands in the Northern Adelaide Plains according to Kraehenbuehl (1996, 1997) and Berkinshaw (2004).

9.0 Helps Road Drainage Corridor

This engineered drainage system begins at Edinburgh North and passes through the RAAF Base Edinburgh land. It then traverses the suburbs of Direk, Burton and Waterloo Corner before entering the Bolivar Waste Water Treatment Plant. Along its way, the watercourse is punctuated by 5 constructed wetlands.

These are:

- Edinburgh North Wetland.
- Edinburgh South Wetland.
- Kaurna Park Wetland.
- Springbank Waters Wetland System.
- Burton Road Wetlands.

QED (2008) had provided a concept plan for revegetation of the part of this corridor extending from Edinburgh South to Bolivar. The following information summarises findings from QED (2008) and provides additional information not found in the former report.

9.1 Pre-European Plant Communities

The portion of the Helps Road Drainage Corridor situated north of Waterloo Corner Road formerly had a *Eucalyptus porosa* (Mallee Box) Woodland, which was locally named the Peachey Belt (Kraehenbuehl 1996). This was made up of trees including Mallee Box *(Eucalyptus porosa),* Native Pine *(Callitris preissii)* and Quandong *(Santalum acuminatum)* with an understorey of shrubs including Emu Bush *(Eremophila longifolia)*, Cassia *(Senna artemisioides)* and Native Lilac *(Hardenbergia violacea)*

The portion of the Helps Road Drainage Corridor extending south of Waterloo Corner Road formerly had a *Austrostipa sp.* (Spear Grass), *Austrodanthonia sp.* (Wallaby Grass) Grassland (Kraehenbuehl 1996).

This plant community is characterised by large open areas dominated by native grasses, groundcovers and annual plants, on the red-brown earth soil associations of the lower alluvial plain. Emerging above the grassland was a sparse scattering of *Eucalyptus camaldulensis* and *Acacia pycnantha* trees and occasional shrubs and saltbushes.

Kraehenbuehl (1996) considered that watercourses in the general area contained woodlands dominated by *Eucalyptus camaldulensis* (River Red Gum).

Detailed species lists for each of the above three pre-European plant communities are presented in Kraehenbuehl (1997)

9.2 Remnant Native Vegetation Currently Present Along the Drains

No naturally occurring remnants of the three pre-European plant communities were found along the Helps Road Drainage Corridor. Presumably the corridor was totally cleared in the past for agricultural purposes.

Also no remnant plant species protected under national or state legislation were found occurring naturally along the Edinburgh to Bolivar Biodiversity Corridor although a number of species with an advisory conservation status for the Southern Lofty Botanical Region were found on site.

The few remnant native species found along the corridor are considered to be recent, disturbance-resistant recolonisers of the area; capable of surviving regular slashing.

The native grasses *Austrodanthonia sp*. (Wallaby-grass), *Austrostipa sp.* (Spear-grass) and *Chloris truncata* (Windmill Grass) were found at almost every unirrigated terrestrial site, accompanied by a number of other native chenopod species.

Wetter segments of the watercourse contained small pockets of aquatic macrophytes. Remnant native terrestrial and aquatic species found along the corridor are listed in APPENDIX 24.

> This engineered drainage system begins at Edinburgh North and passes through the RAAF Base Edinburgh land. It then traverses the suburbs of Direk, Burton and Waterloo Corner before entering the Bolivar Waste Water Treatment Plant.

9.2.1 Native Vegetation Condition

Native vegetation condition present along the constructed drains is best described by Turner (2001) as Condition Scale 6 (Completely Degraded) – The area is completely or almost completely without native species. One exception to this is the eastern end of the Purling Road Drain which is a tributary to the Helps Road Drain System. This ~1.5km revegetation site can now be described by Turner's (2001) Condition Scale as good (ie Condition Scale 4).

Constructed wetlands, offer a significantly wider range of flora species and habitat and therefore host a larger fauna species range. Condition varies from Turner's (2001) Condition Scale 4 (Good) to Condition Scale 3 (Very Good) depending on vegetation density and the number of vegetation strata present at each wetland.

9.3 Constructed Wetlands

As stated earlier, five constructed wetlands occur along various locations within the Helps Road Drainage Corridor. Each wetland is deliberately planted with aquatic and terrestrial vegetation designed to cleanse stormwater and to provide fauna habitat. In some instances, terrestrial plantings contain non-local native plant species. Wholesale removal of these inappropriate plants is not economically justified. However, where a particular species is likely to become an invasive pest, removal is recommended.

9.3.1 Edinburgh North Detention Basin and Wetland

Stage 1 of this wetland, built on East Avenue, Edinburgh was designed as a stormwater detention basin. This basin was designed to release captured stormwater at a controlled rate into the Belchambers Road Drain. This drain flows westwards along the northern boundary of DSTO and RAAF Base Edinburgh before entering and traversing the RAAF Base mid-line in a south-south-westerly direction to Edinburgh South Wetlands.

Recent modifications (2008) to the outlet of the Edinburgh North detention basin have resulted in the drowning of most aquatic macrophytes in the system due to overlong detention of stormwater. Only *Bolboschoenus caldwellii* (Salt Club-rush) has withstood the new water regime.

Intended replacement plantings of the aquatic zone for 2009 will include the planting of *Phragmites australis* (Common Reed), *Marsilea drummondii* (Common Nardoo) and 50 *Muehlenbeckia florulenta* (Lignum) shrubs for bird habitat.

Stage 2 of this wetland will be built adjoining the southern boundary of stage 1 during 2009. This stage is designed specifically as a water cleansing wetland, with alternating shallow, reedy marshes and deeper pools of open water.

A plant species list for this wetland is currently unavailable.

9.3.2 Edinburgh South Wetland

Built at the southern boundary of the RAAF Base Edinburgh this water-cleansing wetland receives stormwater from the drain traversing the RAAF Base. This wetland has been modified so that there will be no open pools of water. This modification is necessary to discourage large water birds from utilising the wetland as there is a risk of bird strike with nearby defence aircraft.

This wetland will have a linear, reedy, low-flow channel leading to an Aquifer Storage and Recovery (ASR) facility. Adjacent the low flow channel will be several overflow basins designed to capture water during relatively rare, but large flow events. These basins will be seeded with a mixture of terrestrial native grasses and chenopod species.

Occasional low trees and large shrubs will add some height to the vegetation planted here.

APPENDIX 25 details the native plant species selected for tubestock planting in the various zones of this wetland. Overflow water from this wetland will enter another constructed drain and travel south west to Kaurna Park Wetland.

9.0 Helps Road Drainage Corridor

9.3.3 Kaurna Park Wetland

This extensive, long established, constructed wetland consists of ~5km of sinuous watercourses and adjacent floodplains within a perimeter levee to contain stormwater on site. Internally it has been designed and planted to simulate a floodplain found along the Gawler River. Low lying floodplain areas have been planted with a *Eucalyptus camaldulensis* (River Red Gum) woodland while slightly elevated areas have been planted to simulate a relatively dense *Eucalyptus largiflorens* (River Box) woodland.

A number of species planted within Kaurna Park Wetland are not endemic to the Adelaide Plains but have been introduced from along the River Murray or further afield. A number of local-native herbaceous and grassy species have colonised the site.

The visual landscape of Kaurna Park Wetland is that of tall trees scattered over creeks, billabongs and floodplains covered with rushes, sedges, grasses and weeds. Tall, medium and small riparian shrub species are mostly lacking except in a small number of locations.

This 49 hectare wetland provides a floodwater detention function and offers the local areas protection from a 1:100 year flood event. Water enters the wetlands through a channel on the northern side of the park and fills the internal creek system. When it overflows the internal creeks it passes overland over the various sections of the *Eucalyptus camaldulensis* (River Red Gum) floodplain to the south-west corner. During its traverse within the wetland the water is partially cleansed. From here, the water either overflows to the Springbank Waters drainage system or is temporarily retained on site in the ASR ponding area for further cleansing.

The wetland also provides:

1. Recycled water for ASR injection.
2. Habitat for a range of local fauna utilising the site.
3. The Wodliparri Indigenous Interpretive Trail intended to showcase plants used by local indigenous people in the past.
4. A passive recreational site for local residents.

APPENDIX 26 lists all native plant species recorded for Kaurna Park Wetlands.

“As drainage lines along the Helps Road Drain System are essentially slashed exotic grasslands, there is limited fauna habitat available. However, the constructed wetlands offer a greater range of plant species and vegetation strata, thereby offering increased opportunity for fauna habitat.”

9.3.4 Springbank Waters Wetland and Waterways

Manicured wetlands fronting Waterloo Corner Road provide an entry statement to the Springbank Waters estate. These continue south-west wards as two waterways through the centre of the Springbank Waters estate. Again waterways are lined with lawned areas planted with widely spaced trees.

The watercourses have permanent water with fringe aquatic macrophyte plantings, which occasionally spread across the waterway. As the waterways contain permanent water, they support many aquatic herbs which are mostly absent from ephemeral wetlands within the City of Salisbury.

Large, ephemeral wetlands occur at the southern end of the watercourses. Plant species found within the Springbank Waters Wetland complex are listed in APPENDIX 27.

9.3.5 Burton Road Wetlands

These are long established wetlands adjacent Burton Road which process stormwater before discharging it to a drain flowing westwards to Pt Wakefield Road. Terrestrial species planted include a mixture of both local and non-local native species. A number of *Casuarina glauca* (Swamp Oak) have been planted on site. This inappropriately planted non-local, native tree species is suckering and forming dense thickets. As it is an invasive species, it is recommended that it be removed and replaced with *Acacia salicina* (Willow Wattle). Native aquatic and terrestrial plant species encountered at Burton road wetlands are listed in APPENDIX 28.

9.3.6 State Protected Plant Species

A number of plant species protected under state legislation (SA NPW Act 1972), have been deliberately planted at one or other of the wetlands that occur within the Helps Road Drain System.

The protected species include:

- *Eragrostis infecunda* (Barren Cane-grass) rated Rare for SA.
- *Juncus radula* (Hoary Rush) rated Vulnerable for SA.
- *Lythrum salicaria* (Purple Loosestrife) rated Rare for SA.
- *Myoporum parvifolium* (Creeping Boobialla) rated Rare for SA.

9.4 Fauna Present Along the Helps Road Drain System

Very little habitat suitable for native mammals, reptiles, amphibians and birds remains on the DSTO and RAAF Base land, with the only mammals likely to inhabit the site being the Ringtail Possum *(Pseudocheisus peregrinus)* and possibly a number of bat species (Rust PPK 1994 quoted in ERM Australia 2001).

Native bird species inhabiting the sites appear to be relatively common parkland species. However, *Cacatua sanguinea* (Little Corellas), *Cacatua tenuirostris* (Long billed Corellas) and other medium-sized parrots including *Eolophus roseicapillus* (Galahs) and *Cacatua galerita* (Sulphur-crested Cockatoos) congregate in large numbers every summer at the RAAF Base posing potential bird strike threats (St. John 2003).

Rust PPK 1994 (quoted in ERM Australia 2001) consider that reptiles and amphibians species likely to be present include common urban species such as *Tiliqua rugosus* (Sleepy Lizard), *Tiliqua scincoides* (Blue-tongued Lizard), *Pseudonaja textilis* (Eastern Brown Snake), numerous members of the Skink family *(Scincidae), Crinia signifera* (Brown Froglet), and *Pseudophryne bibroni* (Short-legged Toadlet).

As drainage lines along the Helps Road Drain System are essentially slashed exotic grasslands, there is limited fauna habitat available. However, the constructed wetlands offer a greater range of plant species and vegetation strata, thereby offering increased opportunity for fauna habitat. Kaurna Park Wetland, for instance provides habitat for 117 bird species, 4 reptiles and 1 mammal species. It can be expected that a number of native bat and frog species would occur there but data is currently unavailable.

Bird sightings along the Helps Road Drain System, including bird breeding information available for Kaurna Park Wetland are presented in APPENDIX 29.

Reptile and mammal sightings are available for DSTO, RAAF Base Edinburgh and Kaurna Park Wetlands. This data is presented in APPENDIX 30.

Aquatic invertebrate data collected by Waterwatch data from 2006 to 2008 indicated that there is generally low species diversity. Most species present are pollution tolerant; indicating generally poor water quality.

> “Use of mulched, dense, single species plantings of attractive, local-native species adds to the visual amenity of these sites. Such plantings can also double as suitable habitat for identified locally disadvantaged fauna species.”

9.4.1 Nationally Protected Bird Species

One nationally protected bird species has been seen at Kaurna Park Wetland. This is Rostratula australis (Australian Painted Snipe) rated Vulnerable under the EPBC Act 1999.

9.4.2 State Protected Bird Species

Ten (10) bird species protected under state legislation (SA NPW Act 1972), have been seen at one or more of the wetlands that occur within the Helps Road Drain System. One is known to be breeding at Kaurna Park Wetland.

The protected species include:

- *Anas rhynchotis* (Australasian Shoveler) rated Rare for SA has been breeding locally.
- *Botaurus poiciloptilus* (Australasian Bittern) rated Vulnerable for SA.
- *Falco peregrinus* (Peregrine Falcon) rated Rare for SA.
- *Gallinago hardwickii* (Latham's Snipe) rated Rare for SA.
- *Melithreptus gularis gularis* (Black-chinned Honeyeater) rated Vulnerable for SA.
- *Neophema chrysostoma* (Blue-winged Parrot) rated Vulnerable for SA.
- *Neophema petrophila* (Rock Parrot) rated Rare for SA.
- *Plegadis falcinellus* (Glossy Ibis) rated Rare for SA.
- *Porzana pusilla* (Baillon's Crake) rated Rare for SA.
- *Stictonetta naevosa* (Freckled Duck) rated Vulnerable for SA.

9.4.3 Bird Species Protected under International Agreements

Eight bird species are protected under international agreements with either Japan, China or the Republic of Korea. These birds are listed in APPENDIX 29.

9.5 Biodiversity Enhancement along the Helps Road Drain System

As stated earlier, QED (2008) had provided a concept plan for revegetation of the drain system and adjacent vacant land, extending from Edinburgh South to Bolivar. SA Urban Biodiversity Unit (DEH) Staff are currently implementing this revegetation plan. This initiative is in response to City of Salisbury's Game Plan (2008) strategy 6.4 where Council is to partner with the SA Urban Biodiversity Unit (DEH) to implement revegetation projects throughout the city.

Opportunities for biodiversity enhancement along the Helps Road Drain Corridor include:

- Re-establishment of reed beds along the drains.
- Creating occasional open pools of permanent water along the watercourse to provide aquatic habitat; drinking water for water-dependent birds; summer refuges for fish, yabbies and frogs and habitat for water birds.
- Planting widely scattered riparian vegetation and River Red Gum *(Eucalyptus camaldulensis)* along the drains. Plant numbers must be kept low to allow rapid water movement during peak flow events.
- Establishment of native grasslands on drain batters and adjacent open spaces in selected locations. This will also provide habitat for native seed eating birds.
- Establishment of Mallee Box *(Eucalyptus porosa)* Open Woodland on selected open spaces adjacent the drain system.
- Provision of nesting boxes, rock piles, fallen logs etc for additional microhabitat diversity in selected locations.

Furthermore, an action plan for enhancement of biodiversity, water quality and recreational usage at Kaurna Park Wetland has been recently produced (Kurylowicz 2009). Figure 6 provides intended revegetation areas within the Kaurna Park Wetland site to enhance biodiversity, provide additional bird habitat and food sources and improve final water cleansing prior to ASR injection.

Revegetation adjacent the Edinburgh Kaurna Trail and local residences, in high public use areas, should also be visually pleasing. Use of mulched, dense, single species plantings of attractive, local-native species adds to the visual amenity of these sites. Such plantings can also double as suitable habitat for identified locally disadvantaged fauna species.

10.0 Dry Creek Corridor

Dry Creek is an ephemeral stream which descends the Para Escarpment from the City of Tea Tree Gully passing through the suburbs of Valley View, Walkley Heights, Pooraka and Mawson Lakes. The segment at Walkley Heights between Walkley's Road and Bridge Road is listed as Metropolitan Open Space (MOSS).

Several tributaries enter Dry Creek at Mawson Lakes. These include the:

- Bennet Road Drain into which enters overflow from the Paddocks Wetland, Montague Farm Wetlands and the Warrendi Road Wetlands.
- Railway Corridor Drain adjacent Parafield Airport and Parafield Airport Wetlands.
- Greenfields Wetlands stages 1 to 3.

10.1 Pre-European Plant Communities

According to Kraehenbuehl (1996) the Dry Creek Corridor and its tributaries passed through five vegetation associations during its journey through the City of Salisbury. These are described below and are mapped in Figure 3.

- *Eucalyptus camaldulensis* (River Red Gum) *+/- Eucalyptus leucoxylon* (SA Blue Gum) Woodland lined the watercourse of Dry Creek watercourse. Site inspections of the Dry Creek Corridor within the City of Salisbury have failed to locate any remnant *Eucalyptus leucoxylon* (SA Blue Gum) trees although they are likely to occur upstream, in the City of Tea Tree Gully.
- An *Austrostipa spp.* (Speargrass), *Austrodanthonia spp.* (Wallaby Grass) Grassland formerly abutted the Dry Creek watercourse between the Pooraka Oval and Briens Road, Pooraka. Each of the tributaries of Dry Creek also flowed through this grassland.
- *Eucalyptus porosa* (Mallee box) Woodland formerly surrounded the Dry Creek watercourse upslope of Briens Road. It also grew in Stock Keeper Reserve and Amundsen Gully; drainage from these reserves now feeds the Paddocks Wetland.
- *Mixed Halosarcia sp.* (Samphire), *Sclerostegia sp.* (Samphire) *Atriplex paludosa* (Marsh Saltbush) *Sarcocornia sp.* (Samphire) Low Shrublands formerly occurred through the suburbs of Mawson Lakes and Dry Creek including the Cheetham Saltfields.
- *Avicennia marina* (Mangrove) Low Woodlands are found on tidal flats of estuarine mud and sands forming extensive communities spreading up to 2km wide around Barker Inlet (Fotheringham 1994). The Dry Creek watercourse flows into Swan Alley Creek, which traverses the Mangroves of Barker Inlet.

10.2 Current Remnant Native Vegetation Present

Vegetation has changed dramatically since 1836. The following provides a picture of remnant native vegetation present along various segments of the Dry Creek Corridor system today.

10.2.1 State Protected Plant Species

Three native plant species, protected under the SA NPW Act (1972), occur naturally along the Dry Creek Corridor and its tributaries. These are:

- *Austrostipa multispiculis* (Spear-grass) rated Rare for SA occurs naturally on south facing hillslopes adjacent the watercourse at Walkley Heights.
- *Myriophyllum crispatum* (Upright Milfoil) which is rated Vulnerable for SA has spontaneously appeared at the Paddocks Wetland a number of years ago, presumably imported by water birds (Barrie Ormsby pers com).
- *Sclerolaena muricata var. villosa* (Five-spine Bindyi) rated Rare for SA is usually found on wetland edges and north-facing slopes of creek and drain batters, west of Salisbury Highway and in open spaces in and adjacent to the Parafield Airport. This thorny, native, annual or biennial plant is often mistaken for a weed. However, it survives and is spread under the annual slashing regime that it is subject to.

10.0 Dry Creek Corridor

A number of other plant species protected under state legislation have been deliberately planted at one or more wetlands that occur within the Dry Creek Corridor system.

The additional species include:

- *Eragrostis infecunda* (Barren Cane-grass) rated Rare for SA.
- *Juncus radula* (Hoary Rush) rated Vulnerable for SA.
- *Lythrum salicaria* (Purple Loosestrife) rated Rare for SA.
- *Myoporum parvifolium* (Creeping Boobialla) rated Rare for SA.
- *Myriophyllum papillosum* (Robust Milfoil) rated Rare for SA.

10.2.2 Valley View Section of Dry Creek Corridor

The linear park consists of relatively broad, gently sloping riverine valley on the Para Escarpment, through which Dry Creek flows. Upstream of Paul's Drive, the watercourse is a highly engineered, deeply sloped channel and consists of a series of disconnected water pools for most of the year. Urban residences abut the linear park on both sides.

Mature *Eucalyptus camaldulensis* (River Red Gum) trees and *Acacia salicina* (Willow Wattle) line the watercourse forming an open woodland. Remnant riparian shrubs, groundcovers and herbs are missing. However, small numbers of *Acacia spp.* (Wattles) have been replanted, some time in the past, and are now mature.

All other vegetation appears to be exotic, except for a few stands of aquatic macrophytes which include *Bolboschoenus caldwellii* (Salt Club-rush), *Phragmites australis* (Common Reed) and *Typha domingensis* (Narrow-leaf Bulrush).

Between Walkley's Road and Paul's Drive, the valley is broader. Remnant, mature *Eucalyptus camaldulensis* (River Red Gum) trees and *Acacia salicina* (Willow Wattle) line the watercourse forming an open woodland.

The riparian shrub layer is again absent whilst the aquatic macrophyte layer is reduced to a sparse scattering of tussocks of a few species along the low flow channel. *Phragmites australis* (Common Reed) which normally grows within the low flow channel of a watercourse is only present on elevated ground adjacent the low flow channel.

It is expected that a combination of past vegetation clearance, heavy shade from overhead trees and high water flows has caused significant species loss and prevented the re-establishment of most aquatic macrophyte species. Revegetation has occurred in the past, by the Friends of Dry Creek Trail Inc, along the valley floor and is consistent with *Eucalyptus camaldulensis* (River Red Gum) woodland.

Valley slopes are more elevated and these have been extensively revegetated with plant species consistent with an *Eucalyptus porosa* (Mallee Box) Woodland. Species used in the various revegetation plantings at Valley View are listed in APPENDIX 32. APPENDIX 33 lists the small number of remnant native plant species recorded between Walkley's Road and Paul's Drive, Valley View. Remnant vegetation present at this site is mapped in Figures 7a to 7d.

10.2.2.1 Significant Pest Plants for the Entire Valley View Site

No Weeds of National Significance (WONS) were found on the site. However a number of species proclaimed for South Australia under the Natural Resources Management Act 2004 occurred. Priority Environmental Weeds found on site are listed in APPENDIX 34.

10.2.2.2 Key Threats and Management Issues for the Dry Creek Linear Park at Valley View.

Disturbances

- Erosion and slumping along watercourse (currently under repair).
- Weed invasion, especially proclaimed and environmental woody weeds, along watercourse and valley slopes.
- Rapid water flows during rain events strip away aquatic macrophytes along watercourse.
- Extensive dry periods during summer responsible for mortality of many aquatic plant species.
- Lack of springs to provide summer flows.

> Dry Creek is an ephemeral stream which descends the Para Escarpment from the City of Tea Tree Gully passing through the suburbs of Valley View, Walkley Heights, Pooraka and Mawson Lakes.

Management Issues

- Control of proclaimed and environmental weeds.
- Control of Kikuyu, which is spreading into the watercourse.
- Lack of soil along most of the length of the low flow channel of the watercourse prevents establishment of aquatic macrophytes.
- Very steep sides along most of the length of the low flow channel of the watercourse prevents establishment of water edge plant species.
- Screen plantings of **Acacia iteaphylla* (Flinders Ranges Wattle) along Walkleys Road are a seed source for weed invasion into the project site.

10.2.3 Walkley Heights Section of Dry Creek Corridor

The Dry Creek Linear Park site follows the Dry Creek watercourse between Bridge Road and Walkleys Road at Walkley Heights. This part of the Dry Creek Corridor is zoned as Metropolitan Open Space System (MOSS). The watercourse flows westwards through a relatively broad valley which rises, on its southern side, to the Yatala Labour Prison. Remnant vegetation present at this site is mapped in Figure 7.

10.2.3.1 *Eucalyptus camaldulensis* (River Red Gum) woodland

A woodland of *Eucalyptus camaldulensis* (River Red Gum) occurs along the watercourse at each end of the site with an approximately 800m cleared section immediately downslope of the Yatala Labour Prison.

Some *Eucalyptus camaldulensis* (River Red Gum) trees are sufficiently large enough to qualify as significant trees under the Development Act 1993 (SA). A number of these older trees contain tree hollows that provide habitat for possums, bats and birds. However, seedlings, saplings and semi-mature trees of this species were also present in places.

The cleared section adjoins the numerous quarries which are found on the northern slopes of the watercourse. However, a relatively recent (~10years) revegetation effort has reinstated *Eucalyptus camaldulensis* (River Red Gum) for approximately 380m of the cleared section of the watercourse.

The downstream segment of this woodland adjoins the Department of Transport Stores. Apart from the presence of a small dense thicket of *Acacia salicina* (Willow Wattle) the majority of the understorey consists of numerous exotic tree and shrub species including **Olea europaea* (Olive), **Fraxinus angustifolia* (Ash) and **Acacia saligna* (Golden Wreath Wattle) over dense **Pennisetum clandestinum* (Kikuyu).

The watercourse contains only a few, sparse, small patches of common rushes and sedges and four *Muehlenbeckia florulenta* (Lignum) shrubs. Rapid water flows within the confines of the low flow channel (approx 5m wide x 1-2m deep) hinder natural re-establishment of aquatic macrophyte vegetation. The stony floor of the low flow channel prevents re-establishment of reed and rush species except in the very few and small niches where some soil remains.

However, the northern service track running between the watercourse and the fenceline of the adjacent Department of Transport Stores has relatively intact native grassland containing at least 6 native grass species and several forbs.

The upstream segment of the *Eucalyptus camaldulensis* (River Red Gum) woodland is relatively free of pest plants but has little native understorey species present apart from isolated individuals or occasional thickets of *Acacia salicina* (Willow Wattle). In one location a large patch of *Poa labillardieri var. labillardieri* (Common Tussock-grass) is found adjacent the watercourse, under the canopy of large *Eucalyptus camaldulensis* (River Red Gum) trees.

The riparian shrub layer was otherwise absent while the aquatic macrophyte layer was reduced to a sparse scattering of tussocks of a few species along the low flow channel. *Phragmites australis* (Common Reed) which should normally grow within the low flow channel of a watercourse is absent there through lack of suitable silty substrate for it to grow in. It does, however, occur along the high flow channel in a few places where there is sufficient soil for it to establish.

Remnant native vegetation species encountered in the *Eucalyptus camaldulensis* (River Red Gum) Woodlands are listed in APPENDIX 35.

10.0 Dry Creek Corridor

10.2.3.2 *Eucalyptus porosa* (Mallee Box) Woodland

Valley sides consist mostly of shallow skeletal soils occasionally with large exposed rocks emerging from the surface. In general, depth of weed cover is directly proportional to soil depth. Approximately half of the northern slopes still contain a scattering of remnant *Eucalyptus porosa* (Mallee Box) trees.

Almost all of the naturally occurring tree and shrub species normally associated with *Eucalyptus porosa* (Mallee Box) appear to be lacking except for a small pocket of remnant *Allocasuarina verticillata* (Drooping Sheoak) found on the upper rim of one quarry. However a number of the understorey shrub species have been reinstated during past revegetation efforts. Native grasses and herbs still remain throughout the areas containing *Eucalyptus porosa* (Mallee Box) with several large patches comprising a relatively intact understorey.

The only evidence of *Eucalyptus porosa* (Mallee Box) woodland on the southern slopes is one old, remnant tree each of *Eucalyptus porosa* (Mallee Box) and Allocasuarina verticillata (Drooping Sheoak).

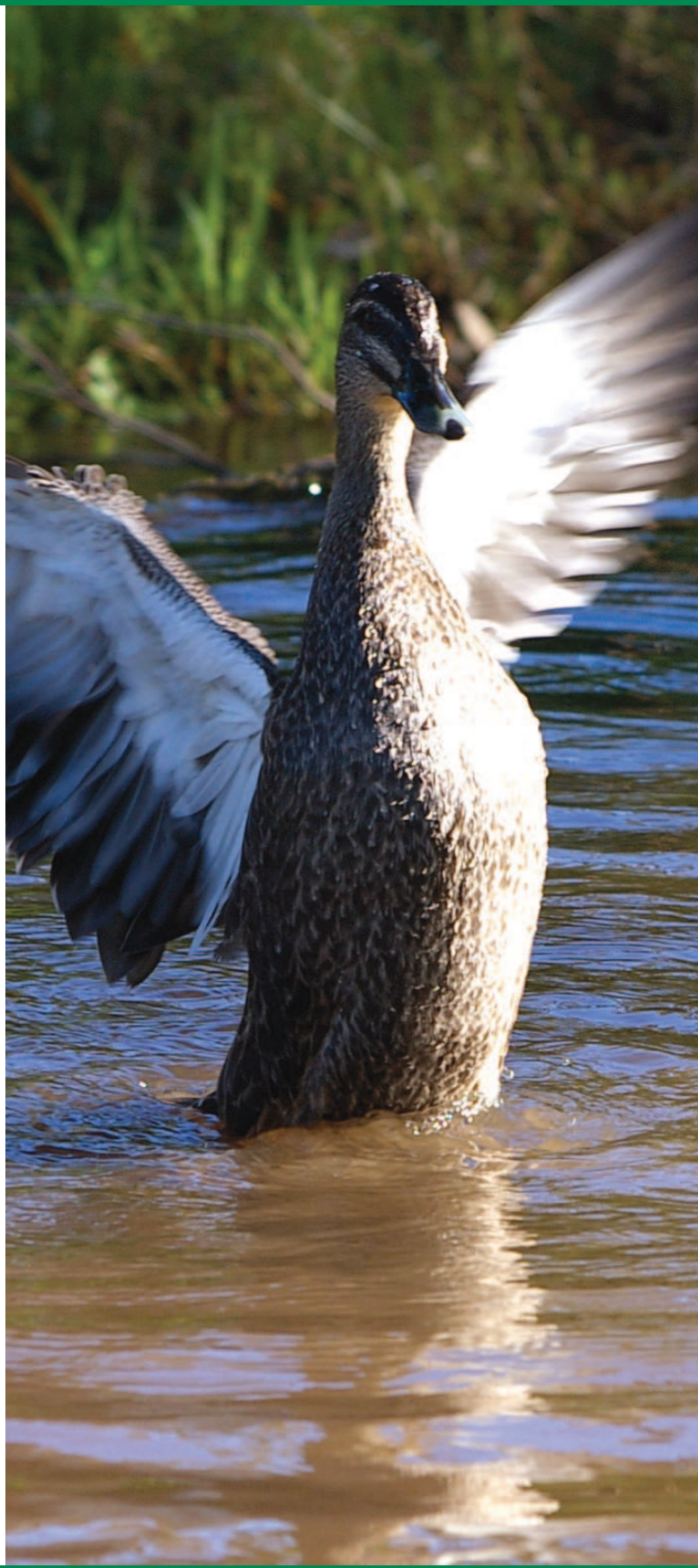
Remnant native vegetation species encountered in the *Eucalyptus porosa* (Mallee Box) Woodlands are listed in APPENDIX 35.

10.2.3.3 Remnant Native Grasslands

In a number of locations the tree and shrub layer has been cleared leaving only relatively intact native grassland, often with associated herbs and groundcovers. Remnant native vegetation species encountered in each of the native grasslands are listed in APPENDIX 35. These sites are mapped in Figure 7d.

In one location, immediately upslope of the proposed flood control dam location is a large patch of native grassland surrounding a smaller but relatively intact patch of *Lomandra densiflora* (Soft Tussock Mat-rush) grassland.

As there is a risk of damage to this grassland site by vehicles during construction of the flood control dam, a separate investigation and report undertaken by the City of Salisbury has recommended the exclusion of all vehicle traffic through the grassland and the construction of alternative pathways through degraded land on the opposite side of the watercourse.



10.2.3.4 Revegetation Sites

Numerous Revegetation areas occur (~10years old) on both the northern and southern valley slopes. In almost all cases they consist of *Eucalyptus porosa* (Mallee Box) *+/-Eucalyptus leucoxylon* (SA Blue Gum) with associated medium to large tree and shrub species. Some revegetation sites contained a small number of species that are not considered native to the northern plains of Adelaide e.g. *Eucalyptus leucoxylon ssp. megalocarpa* (Large-fruit Blue Gum).

It is recommended that these inappropriate species be allowed to remain as they are unlikely to self propagate. However, after their mortality, they should be removed and replaced with local provenance plants.

In some cases pest plants including **Olea europaea* (Olives), **Fraxinus angustifolia* (Desert Ash) and **Acacia saligna* (Golden Wreath Wattle) have self sown in revegetation areas forming large shrubs. These also should be removed from the site.
In general, where revegetated woodlands occur, remnant understorey vegetation is very sparse or absent.

APPENDIX 36 summarises the plant species recorded in each revegetation site.

10.2.3.5 Significant Pest Plants found Along Dry Creek at Walkley Heights

Priority pest plant species proclaimed under State legislation or considered to be local environmental pests are listed in APPENDIX 37. Priority pest plant species are recorded for each of the following zones:-

- *Eucalyptus camaldulensis* (River Red Gum) woodland.
- *Eucalyptus porosa* (Mallee Box) woodland.
- Native Grasslands.
- Revegetation Sites.
- Weedland areas with no native vegetation.

10.2.3.6 Key Threats and Management Issues for the Dry Creek Linear Park at Walkley Heights.

Disturbances

- Weed invasion (especially Kikuyu), and proclaimed and environmental woody weeds.

Management Issues

- Control of proclaimed and environmental weeds.
- Control of Kikuyu, which is spreading into the watercourse.
- Lack of soil along low flow channel of watercourse prevents establishment of aquatic macrophytes.
- Steepl sides along most of the length of the low flow channel of the watercourse prevents establishment of water edge plant species.
- Preventing mortality of aquatic macrophytes during summer dry periods.
- Construction of flood control dam may result in mechanical damage to adjacent native grassland.

10.2.4 Pooraka Section of Dry Creek Corridor

Here, the highly engineered and deeply incised watercourse flows across the relatively flat upper floodplain through the suburb of Pooraka. Water pools rarely occur. The few present are very shallow and are dry for most of the year. Urban residences abut the linear park on both sides.

Mature *Eucalyptus camaldulensis* (River Red Gum) trees and *Acacia salicina* (Willow Wattle) line the watercourse forming an open woodland. Occasional large **Schinus molle* (Pepper-tree) trees also occur. This pest plant should be gradually removed and replaced with *Acacia salicina* (Willow Wattle), *Pittosporum angustifolium* (Native Apricot) or other suitable species.

10.0 Dry Creek Corridor

Naturally occurring riparian shrubs, groundcovers and herbs are missing. However, revegetation of some locations has occurred in the past, thereby increasing the number of plant species present along this section of the watercourse. Species planted are similar to those listed in APPENDIX 38

Rapid water flows during rain events have scoured the watercourse and prevented the establishment of all but a few small tussocks of *Bolboschoenus caldwellii* (Salt Club-rush) and Cyperus gymnocaulos (Spiny Flat-sedge) which are very hardy aquatic macrophytes.

10.2.5 Key Threats for the Dry Creek Linear Park at Pooraka.

Disturbances

- Weed invasion, especially Kikuyu and proclaimed and environmental woody weeds, along watercourse and valley slopes.
- Rapid water flows during rain events strip away aquatic macrophytes along watercourse.
- Steep sides along most of the length of the low flow channel of the watercourse prevents establishment of water edge plant species.
- Extensive dry periods during summer responsible for mortality of many aquatic plant species.

10.2.6 Mawson Lakes and Greenfields Section of Dry Creek Drainage Reserve

A sparse *Eucalyptus camaldulensis* (River Red Gum) Woodland over *Acacia salicina* (Willow Wattle) occurs along the watercourse between Main North Road and The Park Way at Mawson Lakes. This section is highly degraded with a dense invasion of pest tree species including **Acacia saligna* (Golden Wreath Wattle), **Schinus molle* (Pepper-tree) and **Arundo donax* (Bamboo or Giant Reed).

The ground layer is covered with dense weeds and exotic grasses including **Hyparrhenia hirta* (Coolatai Grass). Considerable management inputs will be required to remove the dense pest plant invasion and then replant with local native riparian species. It is understood that this section of the Dry Creek Corridor is under the control of the Land Management Corporation (LMC).

From The Park Way to the Mawson Lakes Interchange, the watercourse is totally engineered and landscaped as an open parkland. A 5m wide low flow channel meanders through a 20m wide, lawned, high flow channel which is trapezoidal in shape. A mixture of local and non-local native trees including **Angophora costata* (Smooth-barked Apple) have been sparsely planted along the high flow channel. The low flow channel is generally weedy with occasional swathes of planted *Bolboschoenus caldwellii* (Salt Club-rush) and small amounts of self established *Typha domingensis* (Narrow-leaf Bulrush).

From the Mawson Lakes Interchange to Port Wakefield Road, the watercourse enters the Dry Creek Drainage Reserve; this has a linear, trapezoid drain which is very weedy, passes along the northern boundary of the Greenfields wetlands. Of interest is the sole population of *Calystegia sepium* (Large Bindweed) within the City of Salisbury, located in this drain immediately downstream of Salisbury Highway. Remnant native vegetation found along this drain and its batters is limited to disturbance resistant species. These few species are listed in APPENDIX 39.

10.2.7 Globe Derby Section of Dry Creek Drainage Reserve

The Dry Creek Drainage Reserve continues adjacent the Saltfields to Swan Alley Creek which traverses the Mangroves of Barker Inlet. Remnant native vegetation found along the batters is limited to disturbance resistant species.

The floor of the drain however, has been colonised with a tidal samphire community comprising relatively dense *Sarcocornia quinqueflora* (Beaded Samphire) and *Suaeda australis* (Austral Seablite) low shrubs. The base of batters on both sides of the drain is now being colonised by young *Avicennia marina ssp. marina* (Grey Mangrove) trees at less than 50m spacings.

Provided these Mangrove trees do not obstruct 1 in 100 ARI flood flows, they should be retained along this section of the drain. In time these trees will provide a habitat corridor for small birds (e.g. wrens) to travel inland from the coastal mangroves as far upstream as Port Wakefield Road.

10.2.8 Parafield Airport Vernal Pools

The southern end of the Parafield Airport is low lying with a number of shallow depressions present. These depressions collect runoff during heavy rainfall events. 11 of these pools (referred to as vernal pools) host unique ephemeral flora for a time; generally during late winter and early spring. The remaining 14 depressions lack native flora and are referred to as hollows by Coleman & Coleman (2002a, 2002b). Six vernal pools and one artificially constructed vernal pool occur in the vacant land between Elder Smith Drive and Bennett Road Drain.

This area also contains at least eight hollows. The remaining vernal pools and hollows occur north of Elder Smith Drive behind the Parafield Airport Security Fence. Overflow water from the vernal pools could potentially enter a local drain which empties into the Bennett Road Drain; this then flows into the Dry Creek watercourse.

The vernal pools have been subject to investigations by a number of consultants including Bush Anew (Coleman & Coleman 2002a, 2002b), Brown & Root (2001) and Coleman & Coleman (2002a, 2002b) prior to the construction of Elder Smith Drive, Parafield. Based of their work, Seaman (2002) reported that this site contained one of the most significant vegetation associations within the Northern Adelaide and Barossa Water Catchment Management Board and he recommended future monitoring of the site. This association present at the time was that of Amphibromus nervosus, Eleocharis acuta, Rumex dumosus and Sclerolaena muricata var. villosa low grassland.

The Threatened Plant Action Group (2004) refers to the Parafield ephemeral wetlands as a critically endangered natural ecosystem of State significance.

Native plant species recorded by Coleman & Coleman (2002a, 2002b) for the Ephemeral (Vernal) Pools adjacent Elder Smith Road, Parafield are listed in APPENDIX 40.

10.0 Dry Creek Corridor

10.2.9 Bennett Road Drain

This weedy, trapezoidal drain runs north-westwards from Main North Road and joins wetlands adjacent Elder Smith Road and adjacent Salisbury Highway before entering the Dry Creek Drainage Reserve. Native vegetation present along the drain and its batters consists of common, disturbance resistance species similar to those listed in APPENDIX 39.

Overflow water from Warrendi Road Wetlands, Montague Farm Wetlands and the Paddocks Wetlands enters Bennett Road Drain.

10.2.10 Railway Corridor Drain and Parafield Airport Wetlands

A concrete lined, deep, trapezoid drain runs parallel to the eastern side of the railway line along the Parafield Airport western boundary. The drain itself lacks native vegetation except for occasional self established clumps of *Typha domingensis* (Narrow-leaf Bulrush) which are regularly sprayed by Asset Services landscape management staff of the City of Salisbury to prevent flooding problems.

Between this drain and the airport fence is the Parafield Airport Plantation which extends from Cross Keys Road at Brahma Lodge to the Dry Creek Drainage Reserve at Mawson Lakes. This plantation consisting of a mixture of local and non-local trees and shrubs planted over moderate to sparse remnant native grassland. Amongst the planted trees, a number of local native grasses herbs and forbs have established. Of particular significance is that this plantation has the only known remnant population of *Dichanthium sericeum ssp. sericeum* (Silky Blue-grass) within the City of Salisbury. This very attractive native grass with distinctive blue foliage has potential for use in revegetation and amenity plantings throughout the City of Salisbury.

APPENDIX 41 lists both naturally occurring and planted species found along the Parafield Airport Plantation.

Wetlands constructed in the adjacent Parafield Airport are connected to the railway corridor drain. Any overflow from these wetlands is directed through the drain to the Dry Creek watercourse. Parafield Airport Wetlands are described below.

10.2.11 Constructed Wetlands

A number of constructed wetlands occur adjacent the Dry Creek Corridor at Greenfields and Mawson Lakes. Each wetland is deliberately planted with aquatic and terrestrial vegetation designed to provide amenity and fauna habitat. Some wetlands, such as the Parafield Airport Wetlands have been designed as high efficiency stormwater cleaners for reuse.

In some instances, terrestrial plantings adjacent the wetlands contain non-local native plant species. Wholesale removal of these inappropriate plants is not economically justified. However, where a particular species is likely to become an invasive pest, removal is recommended. Wetlands associated with the Dry Creek Corridor System are described below.

10.2.11.1 Greenfields Wetland

Greenfields Wetlands were established as three separate stages from 1990 to 1995 to detain flood waters and to provide fauna habitat. This extensive wetland system has been vegetated to mimic a *Melaleuca halmaturorum* (Swamp Paper-bark) tall shrubland over a sinuous watercourse; similar to that which formerly occurred adjacent the Port River and the Patawalonga Creek in the coastal western suburbs of Adelaide. Waterways are vegetated mostly with fringing *Phragmites australis* (Common Reed) reedbeds.

Emerging above the planted *Melaleuca halmaturorum* (Swamp Paper-bark) tall shrubland within stages 1 and 2 of this wetland are occasional thickets of **Casuarina glauca* (Swamp Oak) trees which are spreading from suckering roots. This species is considered inappropriate as it does not originate from South Australia. However, numerous *Phalacrocorax melanoleucos* (Little Pied Cormorant) nest in these trees at Stage 1 of these wetlands and immediate removal is therefore inappropriate.

Replacement plantings of salt-tolerant strains of *Eucalyptus camaldulensis* (River Red Gum) should be made throughout the wetlands. Only when this species has become large enough for the *Phalacrocorax melanoleucos* (Little Pied Cormorant) to nest in them should the **Casuarina glauca* (Swamp Oak) be gradually removed. This may take twenty years or more as locally saline soils currently inhibit growth of the *Eucalyptus camaldulensis* (River Red Gum) trees.

APPENDIX 42 lists plant species initially planted at Greenfields Wetlands accompanied by a small number of native species which have self established near the Watershed Café.

A by-product of the Greenfields Wetlands is the production of relatively clean water for ASR injection. However, as Greenfields Wetlands were not purposely built for water cleansing they lack the extensive, dense reedbeds commonly found in high efficiency water cleaning systems. Such reedbeds may be retro-fitted in future if required.

10.2.11.2 Warrendi Road Wetland

This wetland and associated watercourse occurs on the eastern boundary of the University of South Australia campus. Overflow from this wetland eventually enters the Dry Creek Corridor via the Bennett Road Drain. Terrestrial and aquatic macrophyte species planted on the fringes of the watercourse and main lake are listed in APPENDIX 43.

10.2.11.3 Parafield Airport Wetlands

Three wetland cells have been constructed within the Parafield Airport precinct specifically to produce high quality recycled water for irrigation purposes. These cells are enclosed in netting to discourage avifauna from visiting the site to minimise bird strike threats to aircraft. The central wetland cell is planted with parallel rows of aquatic macrophytes dominated by *Phragmites australis* (Common Reed), *Baumea articulata* (Jointed Twig-rush) and *Schoenoplectus validus* (River Club-rush) with a smaller number of other species to provide some diversity.

The original species list is reproduced in APPENDIX 44.

Any overflow from these wetlands is directed through the railway corridor drain to the Dry Creek watercourse.

10.0 Dry Creek Corridor

10.2.11.4 Paddocks Wetland

Situated at the intersection of Bridge Road and Maxwell Road, this wetland collects run-off from an ephemeral watercourse which descends through Amundsen Gully and Stock Keeper Reserve. Water accumulated at the Paddocks Wetland is cleansed and injected underground via the on-site ASR. High flows which overtop this wetland enter a stormwater pipeline which evacuates into the Bennett Road Drain.

The Paddocks wetland is planted as a series of open, grassy floodplains surrounded by perimeter plantings of large *halmaturorum* (Swamp Paper-bark) shrubs with the occasional *Eucalyptus camaldulensis* (River Red Gum) emerging above them. One section has a tall shrubland of the non-local *Melaleuca styphelioides* (Prickly Paperbark) surrounding a constructed creek.

Many of the terrestrial tree and shrub species planted in the adjacent parklands are not native to the Southern Lofty region. An undated pamphlet published by the City of Salisbury lists terrestrial and aquatic species planted initially in 1977 in the wetland and along the adjacent woodland creeks (City of Salisbury. Undated). This pamphlet reports that 130 species were planted. However, examination of the list indicates that only 31 of these were local species native to the Southern lofty region. The remainder originated from Murray lands or further afield. Fortunately many of the exotic species failed to establish.

APPENDIX 45 lists native plant species currently found in and around the perimeter of the wetlands. Species currently present in the adjacent parkland have not been recorded.

10.3 Condition of Vegetation Communities along the Dry Creek Corridor Today

The City of Salisbury City Landscape Plan (Hassell, 2007 p34) describes the Dry Creek Corridor as severely degraded. Table 13 summarises the current condition of the remnant vegetation associations using the Turner (2001) condition scale.

Table 13 Summary of the Current Condition of the Vegetation Associations Along the Dry Creek Corridor- after Turner (2001)

Location	Vegetation Association Along and Adjacent The Dry Creek Corridor	Turner (2001) Condition Scale
Valley View	*Eucalyptus camaldulensis* (River Red Gum) +/- *Eucalyptus leucoxylon* (SA Blue Gum) Woodland along the Watercourse	Scale 5 (Degraded)
Valley View	*Eucalyptus porosa* (Mallee box) Woodland on valley slopes	Present only as revegetation
Walkley Heights	*Eucalyptus camaldulensis* (River Red Gum) +/- *Eucalyptus leucoxylon* (SA Blue Gum) Woodland along the Watercourse	Scale 5 (Degraded)
Walkley Heights	*Eucalyptus porosa* (Mallee box) Woodland on valley slopes	Scale 5 (Degraded)
Walkley Heights	*Austrostipa spp.* (Speargrass), *Austrodanthonia spp.* (Wallaby Grass) Grassland patches	Scale 4 (Good)
Pooraka	*Eucalyptus camaldulensis* (River Red Gum) +/- *Eucalyptus leucoxylon* (SA Blue Gum) Woodland along the Watercourse	Scale 5 (Degraded)
Mawson Lakes	*Eucalyptus camaldulensis* (River Red Gum) +/- *Eucalyptus leucoxylon* (SA Blue Gum) Woodland along the Watercourse upstream of The Park Way	Scale 5 (Degraded)
Mawson Lakes	Dry Creek watercourse downstream of The Park Way	Scale 6 (Completely Degraded)
Mawson Lakes	*Mixed Halosarcia sp.* (Samphire), *Sclerostegia sp.* (Samphire) *Atriplex paludosa* (Marsh Saltbush) *Sarcocornia sp.* (Samphire) Low Shrublands along watercourse (engineered drain) from Interchange to the Saltfields	Scale 4 (Good) on drain floor.
Mawson Lakes	Warrendi Road Wetland at Uni SA	Scale 4 (Good)
Globe Derby	Dry Creek Drainage Reserve	Scale 4 (Good)
Greenfields	Greenfields Wetlands	Scale 3 (Very Good)
Parafield	Railway Corridor Drain and Parafield Airport Plantation	Scale 5 (Degraded)
Parafield	Parafield Airport Wetlands	Scale 3 (Very Good)
Para Hills West	Paddocks Wetlands	Scale 3 (Very Good)

> Dry Creek is an ephemeral stream which descends the Para Escarpment from the City of Tea Tree Gully passing through the suburbs of Valley View, Walkley Heights, Pooraka and Mawson Lakes.

NOTE: Degraded landscapes are generally characterised by low species diversity, low structural complexity, abundance of weeds and a high risk of degradation from the surrounding landscape.

10.4 Fauna Present Along the Dry Creek Corridor

Associated with the considerable clearance of local native vegetation and loss of fauna habitat is the loss of fauna species supported by these habitats. Fortunately the relatively recently constructed wetlands have reinstated considerable habitat opportunities for a range of animals, especially birds. Fauna data collection for the Dry Creek Corridor system is based on both survey data and anecdotal evidence. Current information is recorded in Table 14.

Table 14 Fauna Data Collected for the Dry Creek Corridor System.

Form	Data Collected
Birds	176 species recorded (mostly at wetlands) of which:- • 1 species is protected under Federal Legislation (EPBC Act 1999) • 17 species are protected under SA legislation (NPW Act 1972). • 38 species are threatened for the Mount Lofty Region. • 22 species are protected under international agreements. • 8 species are introduced species. • 43 species are breeding at wetland sites. See APPENDIX 46 for full lists.
Reptiles	8 species recorded, of which:- • 6 species are lizards. • 1 species is a snake. • 1 species is an introduced tortoise. See APPENDIX 47 for full lists.
Amphibians	4 frog species are recorded. See APPENDIX 48 for full lists.
Mammals	7 species are recorded of which 6 are bat species. See APPENDIX 49 for full list.
Aquatic Invertebrates	38 species recorded at various points along the watercourse See APPENDIX 50 for full list.
Native Fish	5 native fish species recorded for various locations. See APPENDIX 51 for full list.

APPENDICES 46 to 51 provide full lists of all species known to occur along the Little Para River Corridor including occurrences of birds, reptiles, amphibians, mammals and aquatic invertebrates and native fish.

Aquatic invertebrate data collected by Waterwatch (see APPENDIX 51) indicates that water quality along the Dry Creek Corridor is generally not of a high quality. Presumably the ephemeral nature of the watercourse and its tributaries causes fluctuations in water quality, inhibiting the colonisation of the sites with the sensitive invertebrates (i.e. those requiring permanently high water quality).

10.4.1 Nationally Protected Bird Species

One nationally protected bird species has been breeding at Greenfields Wetland. This is Rostratula australis (Australian Painted Snipe) rated Vulnerable under the EPBC Act 1999.

10.4.2 State Protected Species

Seventeen (17) bird species, protected under the SA NPWS Act (1972), occur along the Dry Creek Corridor system. Protected species are:

- *Anas rhynchotis* (Australasian Shoveler) rated Rare for SA.
- *Biziura lobata* (Musk Duck) rated Rare for SA.
- *Botaurus poiciloptilus* (Australasian Bittern) rated Vulnerable for SA.
- *Calyptorhynchus funereus* (Yellow-tailed Black Cockatoo) rated Vulnerable for SA.
- *Cereopsis novaehollandiae* (Cape Barren Goose) rated Rare for SA.
- *Chrysococcyx lucidus* (Shining Bronze-cuckoo) rated Rare for SA.
- *Cisticola exilis* (Golden-headed Cisticola) rated Rare for SA.
- *Coturnix ypsilophora* (Brown Quail) rated Vulnerable for SA.

10.0 Dry Creek Corridor

- *Falco peregrinus* (Peregrine Falcon) rated Rare for SA.
- *Haliaeetus leucogaster* (White-bellied Sea-eagle) rated Vulnerable for SA.
- *Neophema petrophila* (Rock Parrot) rated Rare for SA.
- *Oxyura australis* (Blue-billed Duck) rated Rare for SA.
- *Plegadis falcinellus* (Glossy Ibis) rated Rare for SA.
- *Podiceps cristatus* (Great Crested Grebe) rated Rare for SA.
- *Porzana pusilla* (Baillon's Crake) rated Rare for SA.
- *Rostratula australis* (Australian Painted Snipe) Rare for SA and Vulnerable for Aust.
- *Stictonetta naevosa* (Freckled Duck) rated Vulnerable for SA.

10.5 Opportunities for Biodiversity Enhancement

The City of Salisbury City Landscape Plan (2007 p34) recommends the reinstatement of the River Redgum plant communities along the watercourse and revegetation of the river banks. Such plantings should be sparse to create an open woodland.

Opportunities for biodiversity enhancement along the Dry Creek Corridor are summarised in the following list:

1. Re-establishment of reed beds along the watercourse and drains downstream of Main North Road, for water cleansing and bird habitat.
2. Creating occasional open pools of permanent water along the watercourse to allow summer refuges for native water rats, fish, yabbies and frogs and to provide habitat for water birds.
3. Understorey planting of riparian vegetation beneath the Eucalyptus camaldulensis (River Red Gum) trees; where they occur adjacent the watercourse. This will also provide wildlife habitat for target fauna species (eg small wrens).
4. Enhancement of native grasslands in the Walkley Heights area.
5. Re-establishment of Eucalyptus porosa (Mallee Box) Open Woodland on hillslopes in the Walkley Heights area.
6. Provision of nesting boxes, rock piles, fallen logs etc for additional microhabitat diversity in selected locations.
7. Development of a partnership with the City of Port Adelaide Enfield so that an agreed approach is used by both councils to revegetate and manage the segments of Dry Creek Corridor owned by each council.

Revegetation adjacent the Dry Creek Linear Trail and local residences, in high public use areas should also be visually pleasing. Use of mulched, dense, single species plantings of attractive, local-native species adds to the visual amenity of these sites. Such plantings can also double as suitable habitat for identified locally disadvantaged fauna species.

10.5.1 General Comments

As stated earlier in Section 8.8 above, increasing botanical diversity along any corridor requires that:-

- Plant numbers for species currently present in low numbers be increased.
- A range of locally extinct plant species be reinstated in a configuration approximating pre-European vegetation associations formerly present along that Corridor. Actual species selected may be restricted by supply availability from the plant nursery(s).
- Plants be selected and grouped in appropriate configurations to provide specific habitat requirements for identified locally disadvantaged fauna species.

Revegetation adjacent public pathways and local residences, in high public use areas, should also be visually pleasing. Use of mulched, dense, single species plantings of attractive, local-native species adds to the visual amenity of these sites. Such plantings can also double as suitable habitat for identified locally disadvantaged fauna species.

> Revegetation sites must be designed to ensure that public safety is a high priority. This is practically achieved by ensuring that unobstructed views be available along pathways to allow for passive surveillance.

Revegetation sites must also be designed to ensure that public safety is a high priority. This is practically achieved by ensuring that unobstructed views be available along pathways to allow for passive surveillance. Planting low vegetation in proximity to pathways and taller, denser plantings further away provides the compromise for both public safety and fauna habitat requirements.

Site specific revegetation and management plants should be drawn up prior to commencement of works.

10.5.2 *Eucalyptus camaldulensis* (River Red Gum) Woodland Rehabilitation

Figure 7 shows possible locations where this vegetation association may be reinstated by adding the missing terrestrial and aquatic understorey plantings.

Erosion control and weed control should precede any revegetation efforts along the watercourse. Removal of the dense thatch of **Pennisetum clandestinum* (Kikuyu) along and adjacent the low flow channel is essential as this pest plant will smother any revegetation planted in this zone. Only herbicides approved for use along watercourses should be used e.g. Weedmaster Duo®, Roundup Biactive® or similar.

Vegetation restoration is recommended for the watercourse aquatic environment and the adjacent riparian zone to reinstate *Eucalyptus camaldulensis* (River Red Gum) Open Woodland configured to provide wildlife habitat for target fauna species (eg small wrens). Potential also exists to rehabilitate the watercourse itself along the length of Dry Creek.

It is recommended that a number of local-native aquatic macrophytes and riparian species be planted to assist in watercourse stability and water cleansing. *Phragmites australis* (Common Reed) should be introduced to the floor of the low flow channel and *Marsilea drummondii* (Common Nardoo), *Carex bichenoviana* (Notched Sedge) and *Eragrostis infecunda* (Barren Cane-grass) should be planted along the walls of the low flow channel to assist in erosion control and sediment trapping.

These species should be planted in locations where shade from overhead trees is low. Native riparian species suitable for introduction along the Dry Creek watercourse either within the low flow channel or immediately adjacent to it are listed in APPENDIX 21.

For locations in Pooraka and Valley View where the linear corridor is narrow, it is recommended that revegetation be undertaken mostly on the opposite side of the watercourse to where the public pathway occurs. This allows a measure of safety to passers by.

10.5.3 Grassland Restoration

As stated earlier, remnant native grassland occurs beneath the planted trees of the Parafield Airport Plantation which runs outside and parallel to the airport's western fenceline. This plantation has the only known remnant population of *Dichanthium sericeum ssp. sericeum* (Silky Blue-grass) within the City of Salisbury. Also there are pockets of remnant grassland in the Walkley Heights section of the Dry Creek Corridor.

These native grassland areas will require their own management programmes as indiscriminate slashing will damage the grasses and groundcovers. Recommended species to add to native grasslands along the Dry Creek Corridor are listed in APPENDIX 22.

Potential exists to add some visually striking native plants into these native grasslands such as *Xanthorrhoea quadrangulata* (Yacca) and *Lomandras* (Mat-rushes). These should be placed in dedicated, mulched plots where they will not be slashed.

> This corridor has the greatest native plant diversity within the City of Salisbury, with 162 recorded species. While 89 species are found within the Cobbler Creek Recreation Park, a further 63 others are found in other reserves.

10.5.4 *Eucalyptus porosa* Open Woodland Restoration

South facing slopes at Walkleys Heights and possibly Valley View once supported a *Eucalyptus porosa* (Mallee Box) Open Woodland based on the presence of remnant trees. South facing slopes at Valley View and north facing slopes at Walkley Heights have had an *Eucalyptus porosa* (Mallee Box) Open Woodland planted there some time in the past.

APPENDIX 23 lists species that are suitable for planting in a Eucalyptus porosa (Mallee Box) Open Woodlands in the Northern Adelaide Plains according to Kraehenbuehl (1996, 1997) and Berkinshaw (2004).

10.5.5 Revegetation within Mawson Lakes

Despite the fact that the Dry Creek corridor is landscaped as open parkland, there is opportunity to add a range of aquatic macrophyte plant species along the low flow channel to increase plant diversity and to provide habitat for reed dwelling avifauna such as *Acrocephalus australis* (Clamorous Reed-Warbler) and *Megalurus gramineus* (Little Grassbird) which are currently absent within this section of the watercourse.

Scattering the occasional *Eucalyptus camaldulensis* (River Red Gum) tree along the parkland adjacent to the watercourse will provide continuity of the *Eucalyptus camaldulensis* (River Red Gum) Woodland through Mawson Lakes.

APPENDIX 21 lists appropriate aquatic species for use along the Dry Creek Watercourse, for both permanently wet sections and those sections which dry out in summer.

Provision of permanent pools of water within the local area will also ensure survivorship and range extension of the local native *Hydromys chrysogaster* (Water Rat) which is currently present upstream of The Park Way.

10.5.6 Revegetation along Bennett Road Drain and Dry Creek Drainage Reserve

Both these drain systems are heavily weed infested with minor remnant pockets of aquatic macrophytes present. Revegetating the batters and terrestrial zones of both drain systems with native grassland and chenopods is recommended. Occasional pockets of riparian trees and shrubs should be planted to provide fauna habitat and to offer visual amenity to the corridors.

Establishment of an extensive, dense reedbed of *Phragmites australis* (Common Reed) along the length of the floor of each drain is recommended using a staged approach. The upstream end of each drain should be cleared of weeds and planted with ~100m of *Phragmites australis* (Common Reed) interplanted with small numbers of other macrophyte species.

For each subsequent year, an additional ~100m of drain should be rehabilitated with works progressing downstream until each drain is fully revegetated. This reedbed will also provide habitat for reed dwelling avifauna such as *Acrocephalus australis* (Clamorous Reed-Warbler) and *Megalurus gramineus* (Little Grassbird) which are currently absent.

Provision of permanent pools of water within the drains will provide opportunity for the local native *Hydromys chrysogaster* (Water Rat) to extend its range beyond the Greenfields Wetlands. Establishment of a trash interception device at the upstream end of each drain is also recommended to minimise rubbish inputs to the drains – thereby improving amenity and minimising habitat for feral rats and mice.

10.5.7 Additional Plantings within Wetlands occurring in the Dry Creek System

Each wetland within the Dry Creek Corridor System has only a small range of aquatic species. However, opportunity exists to increase plant species diversity by careful placement of additional species within selected niches. APPENDIX 27 lists a range of aquatic macrophytes and herbs suitable for inclusion in local wetlands.

11.0 Para Escarpment Reserves Corridor

This corridor has the greatest native plant diversity within the City of Salisbury, with 162 recorded species. While 89 species are found within the Cobbler Creek Recreation Park, a further 63 others are found in other reserves. At least 2 reserves have > 72 plant species while a further 3 reserves have >50 species recorded.

This discontinuous corridor along the foothills of the Para Escarpment consists of a number of drainage gully reserves along with the Cobbler Creek Recreation Park and the Boral Quarry site. Some of the original *Eucalyptus porosa* (Mallee Box) Woodland within the council owned reserves is degraded with loss or alteration of most shrubby strata present.

Remnant (and planted) *Eucalyptus porosa* (Mallee Box) trees still occur along roadsides and in reserves throughout the Para Escarpment.

Cobbler Creek Recreation Park, Peppermint Gum Gully and Wynn Vale Gullies are zoned as Metropolitan Open Space.

11.1 Pre-European Plant Communities

Two pre-European vegetation associations formerly occurred along the Para Escarpment. These are:-

1. *Eucalyptus camaldulensis* (River Red Gum) *+/- Eucalyptus leucoxylon* (SA Blue Gum) Woodland located along watercourses including Little Para River, Dry Creek and Cobbler Creek. Remnant *Eucalyptus leucoxylon* (SA Blue Gum) trees occur only in small numbers, along the Little Para Corridor and are absent from the other corridors.

2. *Eucalyptus porosa* (Mallee Box) Woodland on hillslopes and hilltops (Kraehenbuehl 1996).

Austrostipa spp. (Speargrass), *Austrodanthonia spp.* (Wallaby Grass) Grassland (not mapped in Kraehenbuehl 1996) have formed in three locations as a result of clearance of the upper storeys of *Eucalyptus porosa* (Mallee box) Woodland.

These sites are:

- Southern side of the Little Para River Linear Park (Upper) upstream of Main North Road.
- Western lower floodplain area of the Cobbler Creek Recreation Park.
- Selected patches adjacent Dry Creek at Walkleys Heights.

11.2 Current Remnant Native Vegetation Present On Site

Past clearance of remnant native vegetation over most of the Para Escarpment has resulted in significant loss of botanical diversity and fauna habitat. Where remnant vegetation still remains, it usually consists of the dominant tree species over relatively sparse native ground layer plants while native shrubs are often missing. Today most native plant species occur in relatively low numbers and many are very difficult to find.

Remnant native plant species recorded for eleven sites are listed in APPENDIX 52.

11.2.1 *Eucalyptus camaldulensis* (River Red Gum) +/- *Eucalyptus leucoxylon* (SA Blue Gum) Woodland

This association has been discussed in detail for the Little Para River Corridor and the Dry Creek Corridor in their respective sections. Cobbler Creek Watercourse is briefly described below.

11.0 Para Escarpment Reserves Corridor

11.2.1.1 Cobbler Creek Watercourse

The floor of the valley is lined with an open forest of *Eucalyptus camaldulensis* (River Red Gum) trees over a heavily degraded understorey. The watercourse is weedy with occasional colonies of *Typha domingensis* (Narrow-leaf Bulrush) along the low flow channel. Scattered tussocks of *Cyperus gymnocaulos* (Spiny Flat-sedge) and *Cyperus vaginatus* (Stiff Flat-sedge) also occur along the low flow channel. The high flow channel is essentially weedy with occasional patches of the native *Carex bichenoviana* (Notched Sedge) found on the northern side of the watercourse.

11.2.2 *Eucalyptus porosa* (Mallee Box) Woodland

Hillslopes on each of the Para Escarpment sites contain remnant *Eucalyptus porosa* (Mallee box) Woodland vegetation generally in varying states of degraded. South facing slopes tend to have only sparse remnant native plant cover and greater weed depth and density. North facing slopes, by contrast, tend to contain a larger diversity of ground layer species, including native ferns, grasses, lilies and daisies; weeds tend to be smaller and fewer in number.

Understorey plant diversity and density increases in steep, rocky locations which have resisted clearance and grazing by sheep. Overall, *Eucalyptus porosa* (Mallee Box) Woodland sites provide worthwhile habitat for a variety of bird, reptile and mammal species including bats, *Tachyglossus aculeatus* (Echidnas), *Trichosurus vulpecular* (Brush-tailed Possums) and the *Macropus fuliginosus* (Western Grey Kangaroo) (Milne, Croft & Pedler 2003).

Remnant native vegetation, in each of the sites, consists of an overstorey of *Eucalyptus porosa* (Mallee Box) trees occasionally intermixed with small numbers of other tree species such as *Callitris gracilis* (Southern Cypress Pine), *Allocasuarina verticillata* (Drooping Sheoak) and *Pittosporum angustifolium* (Native Apricot). The presence of *Eucalyptus odorata* (Peppermint Box) has not been confirmed by recent surveys, despite it appearing in reports undertaken prior to 1999. No report held by the City of Salisbury and written after 1999 lists the presence of this species.

Understorey species consist of native grasses, herbs and low shrubs. Common species found within gully reserves, Boral Quarry site and Cobbler Creek Recreational Park are listed in APPENDIX 53.

> “Recent revegetation efforts have been better in that there has been an attempt to recreate the original Eucalyptus porosa (Mallee box) woodland using local provenance tree, shrub and groundcover species placed in an authentic configuration.”

11.2.3 *Austrostipa spp.* (Speargrass), *Austrodanthonia spp.* (Wallaby Grass) Grassland

Relatively good quality native grasslands survive where soils are shallow and skeletal (i.e. stones exposed at the surface) whereas poor, weedy grasslands occur where sites have deeper soils.

Enneapogon nigricans (Black-head Grass), *Aristida behriana* (Brush Wire-grass) and a number of species of *Austrostipa sp.* (Spear-grass) were usually present at all sites. Scattered amongst these, in low numbers, were many other native grasses and herbs. In Cobbler Creek Recreation Park, the native grassland has a heavy infestation of the proclaimed exotic grass **Hyparrhenia hirta* (Coolatai Grass). This pest plant has been subject to a number of attempts to eradicate it without total success.

11.3 Past Revegetation Efforts

Most remnant trees and mid storey species have been partially reinstated through revegetation efforts in the past 20 years.

Along the base of most gullies, *Eucalyptus camaldulensis* (River Red Gum) have been planted exclusively. Gully slopes generally have *Eucalyptus porosa* (Mallee Box) planted along with *Eucalyptus leucoxylon* (SA Blue Gum) and the visually more appealing large-fruited form, *Eucalyptus leucoxylon ssp. megalocarpa* (Large–fruited SA Blue Gum). This form originated from the South East of SA. A range of larger shrub species have also been planted on the hill slopes. These are listed in APPENDIX 54.

Occasionally, revegetation plantings contain species which are not considered to originate from the northern Adelaide plains but from further afield or from interstate. Inappropriately selected species are listed in Table 15 below. Fortunately these species were planted in low numbers. Several of them, including *Acacia cyclops* (Western Coastal Wattle), *Acacia iteaphylla* (Flinders Ranges Wattle) and *Casuarina glauca* (Swamp Oak) have the potential to become invasive pests and should be removed.

Recent revegetation efforts have been better in that there has been an attempt to recreate the original *Eucalyptus porosa* (Mallee box) woodland using local provenance tree, shrub and groundcover species placed in an authentic configuration.

Table 15 Inappropriate Plant Species occasionally used in Revegetation Works within the City of Salisbury.

SPECIES	COMMON NAME
Acacia argyrophylla	Silver Mulga-bush
*Acacia baileyana**	Cootamundra Wattle
Acacia cyclops	Western Coastal Wattle
Acacia iteaphylla	Flinders Ranges Wattle
Acacia longifolia ssp. longifolia#	Sydney Golden Wattle
Acacia montana	Mallee Wattle
Acacia pendula	Weeping Myall
Acacia podalyriifolia#	Mount Morgan Wattle
Atriplex nummularia ssp. nummularia	Old-man Saltbush
Brachychiton populneus#	Kurrajong
Callistemon citrinus#	Lemon-scented Bottlebrush
Callistemon rugulosus	Swamp Bottlebrush
Casuarina glauca #	Swamp Oak
*Corymbia citriodora**	Lemon-scented Gum
Corymbia maculata#	Spotted Gum
Eucalyptus cladocalyx #	Sugar Gum
Eucalyptus gomphocephala #	Tuart
Eucalyptus leucoxylon ssp. megalocarpa	Large-fruit Blue Gum
Eucalyptus platypus #	Round-leafed Moort
Eucalyptus salmonophloia#	Salmon Gum
Eucalyptus sideroxylon #	Red Ironbark
Eucalyptus spathulata #	Swamp Mallee
Eucalyptus torquata #	Coral Gum
*Eucalyptus woodwardii**	Lemon-flowered Gum
*Eucalyptus.salmonophloia**	Salmon Gum
*Ficus macrophylla**	Morton Bay Fig
Melaleuca armillaris #	Bracelet Honey-myrtle
Melaleuca nesophila #	Western Honey-myrtle

These species originate interstate.

11.0 Para Escarpment Reserves Corridor

11.4 Protected Plant Species

No plant species protected under Federal legislation (EPBC Act 1999) are known to occur within the City of Salisbury.

Three native plant species rated as Rare under state legislation (NPWS Act 1972) occur along the Para Escarpment foothills.

These are:

- *Austrostipa multispiculis* (Spear-grass). This grass occurs on hill slopes of the Little Para Linear Park (Upper) and some adjacent private properties which front Coomurra Drive. It also occurs in the Bull n' Mouth Reserve and on hill slopes above Dry Creek at Walkley Heights.

- *Bothriochloa macra* (Red-leg Grass). This grass occurs in patches on hill slopes of the Little Para Linear Park (Upper) and adjacent private properties.

- *Dianella longifolia var. grandis* (Pale Flax-lily). This species occurs as a few remnant plants within the 'John Road' section of Cobbler Creek Recreation Park.

Furthermore there are 57 plant species with an advisory Conservation Status for the Southern Lofty Botanical region.

11.5 Condition of Vegetation Communities along the Para Escarpment Today

The condition of native vegetation along the Para Escarpment Corridor as a whole is rated at Condition Scale 4 (Good).

Table 16 summarises the current information and condition of the remnant vegetation within each reserve using the Turner (2001) scale.

NOTE: Degraded landscapes are generally characterised by low species diversity, low structural complexity, abundance of weeds and a high risk of degradation from the surrounding landscape.

Table 16 Vegetation Summary of Para Escarpment Sites (after Turner 2001).

Location	Vegetation Association	Reserve Area (ha)	Area of Remnant Vegetation (ha)	Condition of Vegetation	Total native species	Number of Species with a Conservation Status		
						Aust	SA	SL
Little Para Linear Park (Upper)	*Eucalyptus camaldulensis* over *Acacia salicina, Typha domingensis, Phragmites australis* and exotic grasses Open Forest along watercourse. Open *Eucalyptus porosa* (Mallee Box) Woodland over native grasses and weeds on hillslopes.	23.7	7	4	86		1	22
Coomurra Gully	*Eucalyptus porosa* over *Acacia salicina* and **Olea europea* Open Forest	7.9	1.3	4	21			7
Castieau Reserve	*Eucalyptus porosa* over *Acacia paradoxa, Maireana brevifolia,* and **Hyparrhenia hirta* Open Forest	9.55	6	4	79			26
Bull 'n' Mouth Reserve	*Eucalyptus porosa* over *Pittosporum angustifolium,* planted shrubs and native grasses Open Woodland.	1.5	1.5	4	35		1	16
Cobbler Creek Recreation Park	*Eucalyptus camaldulensis* over *Acacia salicina, Typha domingensis, Phragmites australis* and exotic grasses Open Forest along watercourse. *Eucalyptus porosa* over *Pittosporum angustifolium,* and native grasses Open Woodland.	288 but 271 in CoS	144		90		7	36
Cobbler Creek, Salisbury East	*Eucalyptus camaldulensis* over *Acacia salicina* and *Acacia paradoxa* Open Forest	8.6	2.43	4	6			4
Boral Quarry, Salisbury East	*Eucalyptus porosa* over *Pittosporum angustifolium* Woodland.	290.1	99.5	4	73		1	26
Peppermint Gum Gully (includes Kiekebusch Road Reserve)	*Eucalyptus porosa, Eucalyptus camaldulensis* over *Acacia paradoxa, Dodonaea viscosa* Open Forest	16.2	4.5	4	60			22
Wynn Vale Gullies	*Eucalyptus porosa* Very Open Woodland (planted)	39.58		4				
Yulinda Gully	*Eucalyptus porosa* Very Open Woodland (mostly planted)	8.56		4				
Thomas Gully	*Eucalyptus porosa* Very Open Woodland (highly modified over revegetation plantings)	7.23		4				
Kesters Road Reserve/ Pretijohn Gully	*Eucalyptus porosa,* over *Acacia paradoxa,* and *Senna artemisioides* Open Forest	12.9	3	4	28			7
Amundsen Gully/ Stock Keeper Reserve	*Eucalyptus porosa* Very Open Woodland (highly modified over revegetation plantings)	8.7		5				
Dry Creek Linear Reserve (Valley View)	*Eucalyptus camaldulensis* Woodland (highly modified over revegetation plantings)			4	14			2
Dry Creek Linear Reserve (Walkley Heights)	*Eucalyptus camaldulensis* over **Schinus molle, Acacia salicina, *Olea europea* Open Woodland *Eucalyptus porosa,* over *Acacia paradoxa, *Olea europea, Acacia ligulata, *Piptatherum miliaceum, Themeda triandra, Austrostipa sp.* Open Woodland	32.7	11	4	66		1	22
Dry Creek Linear Reserve (Pooraka)	*Eucalyptus camaldulensis* over **Schinus molle, Acacia salicina* Woodland (highly modified over revegetation plantings)			4	5			2

11.0 Para Escarpment Reserves Corridor

11.6 Significant Pest Plants

No Weeds of National Significance were found in any site along the Para Escarpment. Good management by Asset Services landscape management staff of the City of Salisbury has resulted in low frequency of proclaimed pest plants along the corridor. **Chrysanthemoides monilifera* (Boneseed), **Crataegus monogyna* (Hawthorn), **Lycium ferocissimum* (African Boxthorn), **Olea europaea ssp. europaea* (Olive) and **Rosa canina* (Dog Rose) are rarely found. However, pest plants still do occur in pockets, usually where access is difficult.

Some pest plants are not recognised as such and are consequently left to grow and spread. These include **Acacia saligna* (Golden Wreath Wattle), **Casuarina glauca* (Swamp Oak), **Pinus halepensis* (Aleppo Pine) and **Pennisetum clandestinum* (Kikuyu). The area of highest pest plant concentration is along the base of gullies where dense **Pennisetum clandestinum* (Kikuyu) and **Hyparrhenia hirta* (Coolatai Grass) generally occur; the latter spreading upslope.

**Diplotaxis tenuifolia* (Lincoln Weed) is a proclaimed pest plant in South Australia. It is a summer active and very drought tolerant plant and appears to be a relatively recent arrival within the City of Salisbury. It is currently present in low numbers along the Para Escarpment in some gully reserves, on some private property and along some roadsides. If left unchecked it has the potential to spread rapidly and become a major environmental concern.

11.7 Key Threats and Management Issues

Disturbances

- **Pennisetum clandestinum* (Kikuyu) smothers gully floors and localised places on gully slopes which receive stormwater runoff.
- **Acacia saligna* (Golden Wreath Wattle) is spreading unchecked in all reserves.
- **Hyparrhenia hirta* (Coolatai Grass) is a persistent pest despite regular spraying efforts.
- **Diplotaxis tenuifolia* (Lincoln Weed) has the potential to become a significant threat, if left unchecked.
- Dumping of rubbish and garden prunings in gullies.
- Feral bee hives occupying tree hollows and occasional rabbit burrows to the exclusion of native fauna.

Management Issues

- Ensuring casual surveillance of sites is possible while re-establishing natural-looking remnant native associations along the corridor.
- Wild fire management.

11.8 Fauna along the Para Escarpment Sites

Dramatic changes to vegetation structure along the Para Escarpment Sites and significant species loss has also resulted in significant habitat loss.

Fauna data collection for the the Para Escarpment Sites is based on both anecdotal evidence and surveys. However no data exists for many of the reserves to date. Current information is recorded in Table 17.

Table 17 Fauna Data Collected for the Para Escarpment Reserves

Form	Data Collected
Birds	113 species recorded, of which:- • 1 species is protected under international agreements. • 5 species are protected under SA legislation (NPW Act 1972). • 8 species are introduced species. See APPENDIX 55 for full lists.
Reptiles	9 species recorded, of which:- • 1 species is nationally protected (EPBC Act 1999) • 7 species are lizards. • 1 species is a snake. • 1 species is an introduced tortoise. See APPENDIX 56 for full lists.
Amphibians	1 frog species are recorded. See APPENDIX 56 for full lists.
Mammals	5 native species are recorded. See APPENDIX 57 for full list.

APPENDICES 55 to 57 provide full lists of all species known to occur along the Para Escarpment reserves including occurrences of birds, reptiles, amphibians and mammals.

11.8.1 Nationally Protected Fauna Species

Aprasia pseudopulchella (Flinders Ranges Worm-lizard) rated Vulnerable (EPBC Act 1999) has been recorded in the Little Para Linear Park (Upper) zone, upstream of Main North Road in stony terrain. (PJ Matejcic (SA Herp Group) unpublished data).

This species is also recorded in the nearby Cobbler Creek Recreation Park (EPBC Website - accessed Feb 09). Insufficient data exists to determine whether this species also occurs in other Para Escarpment reserves.

Additional information about this species is provided in section 8.7.1 above.

11.8.2 State Protected Species

Five bird species protected under the SA NPWS Act (1972) have been recorded in the Cobbler Creek Recreation Park. Insufficient data exists to determine whether these species also occur in other Para Escarpment reserves. Protected species are:

- *Chrysococcyx lucidus* (Shining Bronze-cuckoo) rated Rare for SA
- *Coracina papuensis* (White-bellied Cuckoo-shrike) rated Rare for SA
- *Falco peregrinus* (Peregrine Falcon) rated Rare for SA
- *Stagonopleura guttata* (Diamond Firetail) rated Vulnerable for SA.
- *Turnix varia* (Painted Button-quail) rated Vulnerable for SA.

11.9 Opportunities for Biodiversity Enhancement

Restoration of pre-European vegetation conditions is not achievable due to cost restraints. Nevertheless it is possible to create a net environmental gain within each gully by:

- Securing the survivorship of locally threatened plant species
- Increasing the number of native plant species.
- Increasing the abundance of each native species present.
- Establishing habitats for targeted, locally-disadvantaged fauna.
- Planting in locations where native plants have a competitive advantage over weeds (e.g. steeper, stony sites with thin, nutrient-poor soils, and north facing slopes which are hotter and drier than south facing slopes).
- Using low-impact planting techniques to minimise soil disturbance.

Opportunities for biodiversity enhancement along the Para Escarpment Corridor include:

- Understorey planting of riparian vegetation beneath the Eucalyptus camaldulensis (River Red Gum) trees; where they occur adjacent the watercourse along a few gullies.
- Enhancement of native grasslands in the Little Para Linear Park (Upper) area and the Walkley Heights area.
- Re-establishment of Eucalyptus porosa (Mallee Box) Open Woodland within each gully reserve.
- Provision of nesting boxes, rock piles, fallen logs etc for additional microhabitat diversity in selected locations.
- Develop partnerships with the City of Tea Tree Gully so that an agreed approach is used by both councils to revegetate and manage the segments of gully reserves owned by each council.

11.0 Para Escarpment Reserves Corridor

Where possible, revegetation adjacent the Western gullies Trail in high public use areas should also be visually pleasing. Use of mulched, dense, single species plantings of attractive, local-native species adds to the visual amenity of these sites. Such plantings can also double as suitable habitat for identified locally disadvantaged fauna species.

11.9.1 Factors Which Impact on Biodiversity and Habitat Establishment

11.9.1.1 Wild-fire Management

Australia is a fire-prone continent. Increasing native vegetation cover within the escarpment gullies will potentially increase future fuel loads thereby increasing fire damage risk to adjacent residences. Any future revegetation works within the Para Escarpment Corridor must:

- Maintain adequate offset distances from private property fencelines, public infrastructure, tracks and firebreaks.
- Maximise the use of summer-active, ground cover native grasses and plants to suppress fire movement through the leaf litter.
- Minimise the use of trees and shrubs with oil-bearing foliage. Where such shrubs are required to provide habitat they should be placed in widely spaced clusters. Clustering will concentrate food and shelter resources for fauna while spacing the clusters will minimise fire spread from one cluster to another.
- Maximise the use of moisture-retaining, native vegetation to retard fires. Long bands of sacrificial, fire retardant vegetation could be placed downslope of fire breaks located nearby residences. If necessary, these sacrificial plantings may consist of non-local plant species if it is found that local native plants are deemed to offer insufficient resistance to burning. (NOTE: Fire retarding vegetation will mainly have a significant effect during a relatively cool burn).

11.9.1.2 Minimising Weed Competition

Revegetation should mostly occur in locations where native plants have a competitive advantage over weeds. These locations include:

- Steeper, stony sites with thin, nutrient-poor soils which are unfavourable to weeds but native plants are able to survive there. Areas of low gradients should be avoided as these generally have deeper, moister soils which favour weeds.
- North facing slopes which are hotter and drier than south facing slopes. Native species cope better with lower soil moisture levels than weeds do.

Future revegetation should also not occur in locations where dense pest plant invasions have occurred in the recent past, as the soil surface there is still littered with large numbers of dormant pest-plant seeds. Areas of **Hyparrhenia hirta* (Coolatai Grass) invasion are especially to be avoided.

Disturbance of the soil surface in these locations, by digging or vehicle traffic, will stimulate germination of the pest plant seeds, resulting in the smothering of the native plants installed there. High cost inputs will then be required to protect revegetation in these areas as weeds will need to be carefully hand pulled to protect the native plants.

11.9.2 Restoration of a modified *Eucalyptus camaldulensis* Open Woodland in Council Reserves

Eucalyptus camaldulensis (River Red Gum) trees have been planted along the base of a number of gullies within the Para Escarpment. Generally understorey shrubs and ground covers are missing.

It is recommended that these lower strata plants be added to increase biodiversity. Suitable species for use in a *Eucalyptus camaldulensis* (River Red Gum) Woodland are listed in APPENDIX 21.

11.9.3 Restoring Grasslands

Pockets of remnant grassland occur on elevated ground of the Walkley Heights section of the Dry Creek Corridor and in the Little Para Linear Park (Upper) area.

These native grassland areas will require their own management programmes as indiscriminate slashing will damage the grasses and groundcovers. Recommended species to add to native grasslands along the Dry Creek Corridor are listed in APPENDIX 22.

11.9.4 Restoration of a modified Eucalyptus porosa Open Woodland in Council Reserves

Gully Reserve slopes once supported a *Eucalyptus porosa* (Mallee Box) Open Woodland. Tubestock planting of additional *Eucalyptus porosa* (Mallee Box) trees to restore an open woodland is recommended. This would entail placing all trees at average stem separations of approximately 8-10 metres thereby providing a final canopy cover at maturity of 15 to 30%. At this density, tree canopies do not intersect, thus minimising the spread of a crown fire.

The ground layer should be planted with a large number of low-growing, summer active species to provide moist foliage for visual amenity and fire retardance. Clusters of 5 to 15 native shrubs for fauna habitat should be spaced at 30 to 50m separations. They should also be offset from paths by at least 10m to allow natural surveillance of the sites by passive recreational users.

A broad band of relatively low (≤1m) fire retardant shrubs should be planted immediately downslope of any firebreak located adjacent adjoining residences. Plant species for this band have not been determined yet but future experimental plantings will determine the best species mix for the desired result.

APPENDIX 23 lists species that are suitable for planting in a *Eucalyptus porosa* (Mallee Box) Open Woodlands in the Northern Adelaide Plains according to Kraehenbuehl (1996, 1997) and Berkinshaw (2004).

Site specific revegetation and management plants should be drawn up for each reserve prior to commencement of any works.

11.9.5 Linking Reserves in the Biodiversity Corridor

Currently there is limited opportunity for linking the various Para Escarpment Gully Reserves as residential areas occur between the reserves. The discontinuous nature of the corridor limits movement of fauna between adjacent reserves. Larger birds can fly between the sites while the more-robust mammals (Possums), the larger lizards (Eastern Bluetongues & Shinglebacks) and some skinks and geckoes will readily migrate through urban properties from one site to another.

However, more timid species including those which require specialised habitats (e.g. rocky outcrops) are limited in their movements and may become confined to a particular location.

Additional research and planning is required to determine ways to link the discontinuous reserves, perhaps using suitable roads as corridors (e.g. Nelson Road).

12.0 Biodiversity Outside of the Five Primary Corridors

Suburban Reserves.
Many reserves within the City of Salisbury have large, mature Eucalyptus trees including River Red Gums *(Eucalyptus camaldulensis)*. These large trees produce copious quantities of flowers and host significant populations of invertebrates (e.g. insects) thereby sustaining numerous nectar and insect feeding birds. These trees provide nesting sites for a range of urban birds and where such trees have hollow limbs or trunks, they also provide habitat and refuges for geckoes, bats, possums, parrots and kookaburras.

Streetscape Tree Plantings.
Planted with an extensive range of non-local Eucalypt and Wattle species these provide movement corridors for mobile fauna species between the primary biodiversity corridors. Street trees, like those in urban reserves, provide urban fauna with refuges and feeding and nesting resources.

Ephemeral, Urban Wetlands.
Scattered throughout the City of Salisbury these wetlands generally have their basins planted with flood-tolerant sedges and rushes while the surrounding terrain is vegetated with flowering trees and shrubs.

Populations of nectar and insect eating birds visit the terrestrial vegetation, while water birds such as Little Pied Cormorant *(Phalacrocorax melanoleucos),* White-faced Heron *(Egretta novaehollandiae),* Wood Duck *(Chenonetta jubata)* and Pacific Black Duck *(Anas superciliosa)* visit when open water is found in these wetlands. Pacific Black Duck *(Anas superciliosa)* are known to breed in these ephemeral wetlands during spring.

ETSA Transmission Line Corridors.
These secondary corridors provide links, allowing a range of fauna species to traverse the urban environment between the primary biodiversity corridors. Plantings along these corridors consist of a mixture of local and non-local native plant species which provide useful resources for local fauna species.

Biodiversity resources outside of the five primary corridors have not been quantified to date.

13.0 Priority Order for Biodiversity in Salisbury

The following order of priority for conservation of biodiversity assets is recommended.

Protect, restore and manage:-

1. Populations and habitats of nationally protected fauna species found within the City of Salisbury. These include:
    - *Aprasia pseudopulchella* (Flinders Ranges Worm-lizard) rated Vulnerable.
    - *Rostratula australis* (Australian Painted Snipe) rated Vulnerable.
    - *Tecticornia flabelliformis (syn. Halosarcia flabelliformis)* (Bead Samphire) rated Vulnerable.
2. Any state and Adelaide Mount Lofty Ranges (AMLR) protected vegetation communities. Present within the City of Salisbury are remnants of a number of protected ecological communities as listed in Willson & Bignall (2008); most in various states of degradation. Local protected ecological communities are listed in Table 18.

Table 18 AMLR Priority Ecological Communities Present within the City of Salisbury

AMLR Priority	Ecological Community	Current Presence in the City of Salisbury
Very High	Freshwater wetlands	8 ephemeral wetlands (Vernal pools) located adjacent and within southern boundary of Parafield Airport (Seaman 2002)
Very High	*Themeda triandra +/- Danthonia spp.* Tussock Grassland on heavy fertile soils of plains and hill slopes.	Degraded anthropomorphic pockets on skeletal soil in remnant E. porosa woodland at Para Escarpment Gully sites
High	*Gahnia filum* Sedgeland on drainage lines and depressions	Small coastal remnants and plantings at St Kilda. Also plantings at Kaurna Pk Wetland
Medium	*Allocasuarina verticillata* Grassy Low Woodlands on clay loams of low hills.	One tiny pocket at Dry Creek, Walkley Heights
Conservation concern	*Eucalyptus porosa* Woodlands & Grassy Woodlands	Degraded remnant populations in Para Escarpment Gully sites and Cobbler Creek RP.
Conservation concern	*Melaleuca halmaturorum* Shrubland/ Low Open Forest	No remnants but has been reconstructed at Greenfields and Paddocks Wetlands

AMLR = Adelaide Mount Lofty Ranges

3. Any state and AMLR protected fauna populations and habitats found within the City of Salisbury.
4. Any other vegetation communities found within the City of Salisbury. The following vegetation communities occur within the City of Salisbury which also require protection, restoration and management.
    - *Eucalyptus camaldulensis* (River Red Gum) +/- *Eucalyptus leucoxylon* (SA Blue Gum) Woodland
    - *Avicennia marina* (Mangrove) Low Woodlands
    - Mixed Samphire Low Shrublands.
5. Any other fauna populations and habitats found within the City of Salisbury.

14.0 Biodiversity Corridor Project Management

It is recommended that a Biodiversity Corridor Project Coordinator position be established within the biodiversity team of the City Projects Division of council. The person in this position will report to the Environment Management Officer and regularly consult with the Manager Parks and Landscape.

This person will need to have considerable botanical and horticultural experience, with a history of establishing and managing large scale and ongoing, terrestrial and wetland revegetation projects. Furthermore, this person will need a sound knowledge of the habitat requirements of targeted, threatened fauna to ensure that future plantings faithfully provide such habitats.

The person will be responsible for:

- Planning the forthcoming year's revegetation works in accordance to the CoS Biodiversity Plan.
- Liaising with CoS Asset Services management staff, especially the Manager of Parks and Landscape and the Co-ordinator of Open Space.
- Placement of plant orders with specialist native plant nurseries, including the CoS nursery, for the forthcoming year's plantings.
- Purchasing and co-ordinating delivery of necessary adjunct items for revegetation works including herbicides, fertilisers, tree guards, weed mats, mulch, irrigation piping, etc.
- Directing of site preparation prior to revegetation. Tasks will include directing weed control, site levelling, soil amelioration, mulching and irrigation establishment (if required).
- Ensuring that each plant species is planted according to its niche requirements.
- Ensuring that plantings are configured to re-establish suitable habitat for targeted fauna species.
- Undertaking monthly site inspections to determine follow on weed control, pest and disease management, supplementary watering etc.
- Determining and overseeing a program of ongoing maintenance of revegetated sites; a specialised team of workers based at Asset Services will undertake maintenance works.
- Inspecting sites for fire hazard prevention.
- Maintaining 'quality ecosystems and a safe setting' along the biodiversity corridors as per City of Salisbury Landscape Plan requirements (Hassell, 2007, p146).

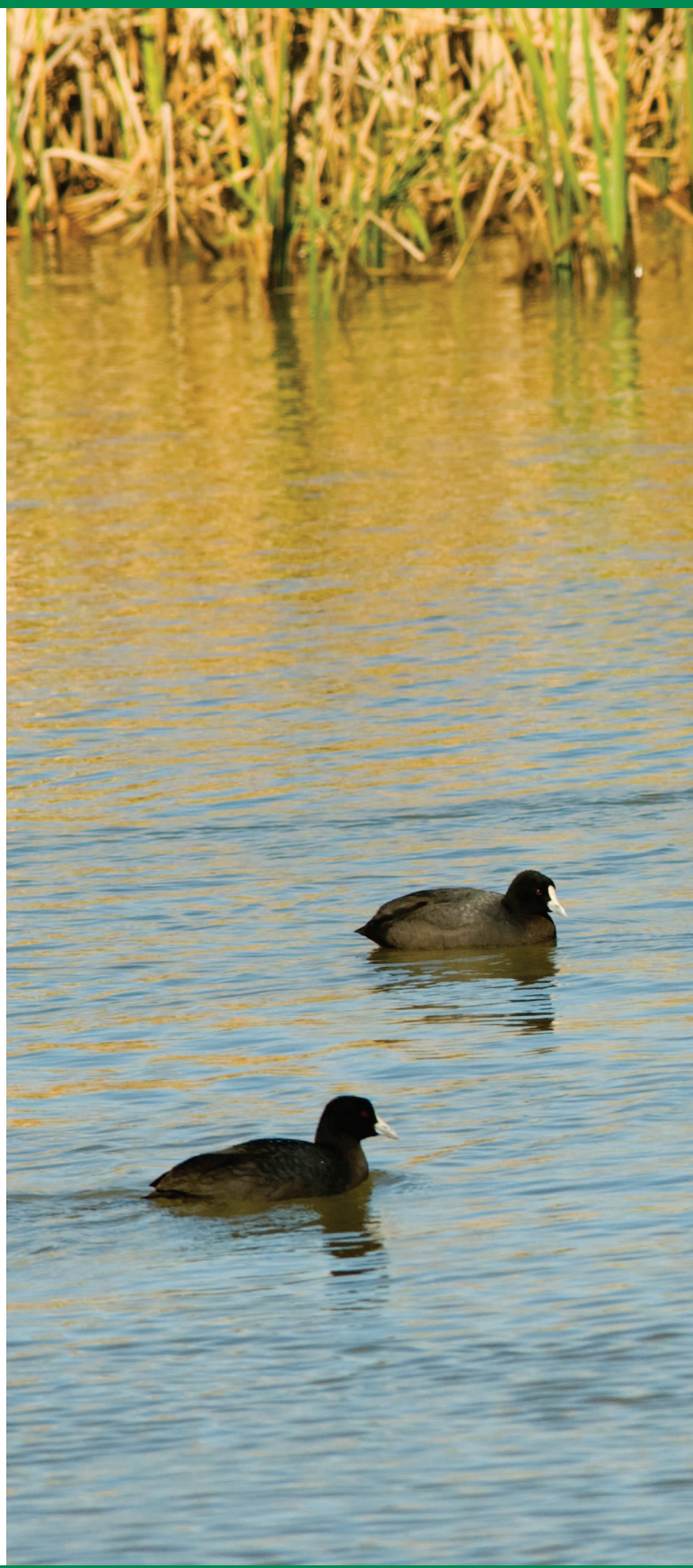
15.0 Cost Reduction Strategies

Re-instating native vegetation along large areas of each of the corridors will require considerable funding.

Two cost cutting strategies are recommended.

- Biodiversity landscape maintenance is a long term and expensive requirement to ensure successful establishment of revegetation and fauna habitat. It also requires specialised skilled staff. A strategy of resourcing and building a biodiversity maintenance team within council, under the direction of the Manager Open Space within the Assets Services Division, will be cost effective in the longer term as opposed to engaging external contractors exclusively. It will also provide the retention of site specific knowledge within council. This biodiversity team will require a dedicated vehicle, equipment and materials during the first two years with an additional vehicle fitted out for herbicide application and fire control being allocated in year 3 of the project.

- Growing plants directly in their final destination rather than pre-growing then in plant nurseries should reduce costs and shorten establishment times. Experimentation with cost reducing strategies such as the use of direct seeding, niche seeding and growing cutting directly in their final destination are recommended.



16.0 Action Plans

16.1 Strategic Actions

1. Collect population data and then develop a local recovery and management plan for each of the nationally threatened species present within the City of Salisbury including the:

    - Australian Painted Snipe *(Rostratula australis).*
    - Bead Samphire *(Tecticornia flabelliformis).*
    - Flinders Ranges Worm-lizard *(Aprasia pseudopulchella).*

2. Investigate water level requirements for the nationally protected Australian Painted Snipe *(Rostratula australis)* in order to ensure that wetland water levels at Greenfields Wetland are adequately maintained to maximise the feeding and breeding cycles of this species.

3. Undertake bi-annual population surveys of birds, bats, frogs, Water Rats *(Hydromys chrysogaster)* and reptiles within wetlands and corridors to determine population distribution and trends.

4. Develop a recovery and management plan for selected, state threatened species present within the City of Salisbury e.g. the Black-chinned Honeyeater *(Melithreptus gularis gularis).*

5. Develop rehabilitation and management plans in co-operation with the staff from the adjacent council for reserves which abut or cross council borders.

6. Ensure all revegetation plantings undertaken adjacent public pathways allow for ready surveillance of the site for public security.

7. Undertake trial plantings of fire retardant vegetation in Para Escarpment reserves to supplement firebreak barriers located adjacent adjoining residences.

16.2 Corporate Actions

16.2.1 Funding

Indicative costings to undertake initial plantings for each of the five biodiversity corridors are presented in APPENDICES 59 a to f. These do not include post-establishment maintenance costings for each site.

Currently there is no dedicated funding to undertake the proposed biodiversity works within the City of Salisbury. Funding is to be sourced from internal and external sources as follows:

1. City of Salisbury biodiversity plans will be submitted to external authorities such as DEH, AMLRMRMB, DWLBC etc for approval to subsequently enable council to develop a framework to apply for like-for-like funding through various programs. It is noted that negotiations have commenced concerning funding however there is no commitment from agencies at this stage and therefore funding will be direct from Council for the below projects and programmes.

2. It is proposed to create a capital budget line of $55,230 for the 2010/11 year and $13,100 for the following year, for a 10 Ha, biodiversity pilot site with an ongoing program in 2012/13 for a subsequent 10 Ha Site along the Little Para Corridor.

It is also proposed to reallocate assets maintenance expenditure to other areas and reduce in future years.

3. It is proposed to implement a biodiversity management training program for selected asset services staff to skill them for care and maintenance of newly created biodiversity sites. (Training Budget of $5,000 in 2011/12 and onwards)

4. $25,000 to be included in Biodiversity Operational Budget annually for monitoring of on-ground works; update of Biodiversity Plan and biennial reporting.

16.2.2 Reporting

Monitoring of the success of biodiversity recovery plans and other remedial works is intended on a biennial basis. Results from monitoring will be reported to Council and will also steer future biodiversity projects.

16.3 Specific Actions

1. Create a Blue Wren corridor along the length of the Little Para River to join the populations present in the coastal Mangroves with those in the foothills by planting small clusters of shrubby bushes at intervals of about 50m along the parts of the Little Para River Corridor that currently lack such habitat.

2. Create occasional open pools of permanent water along the Little Para and Dry Creek corridors to provide adequate habitat including summer drinking water for water-dependent, local birds; to allow summer refuges for fish, yabbies, native water rats and frogs and to provide habitat for water birds.

3. Develop an annual monitoring system for revegetation project sites to determine the effectiveness of remedial measures and to propose further improvements to on-ground programs.

4. Establish a 10 Ha pilot site consisting of 9Ha of native grasslands adjacent public pathways and 1 Ha of woodland offset >20m from pathways along the Little Para River Corridor. Investigate cost reducing revegetation strategies such as using direct seeding, niche seeding, plant division and cuttings. (See Appendices 60a-c for details and budget estimates and Figure 8 for proposed 2010/11 work site and Figure 9 for proposed 20012/13 work site).

The low grassland vegetation will also allow safe public movement along the corridor by allowing passive surveillance along pathways.

5. Investigate opportunities to artificially maintain minimum water levels in outlet ponds of major wetlands in order to keep reedbed biofilms active all year long and to ensure survival of drought sensitive aquatic plant species.

6. Plant additional SA Blue Gum *(Eucalyptus leucoxylon)* along the Little Para River Corridor as part of a local recovery plan for the SA Vulnerable (NPW Act 1972) Black-chinned Honeyeater *(Melithreptus gularis gularis)*.

7. Plant patches of riparian understorey vegetation beneath the River Red Gum *(Eucalyptus camaldulensis)* trees adjacent all watercourses. This will also provide wildlife habitat for target fauna species (eg small wrens).

8. Provide suitable non-biotic elements including perching trees, nesting boxes, rock piles, fallen logs etc for resident fauna species requiring such habitats.

9. Expand reed beds in suitable positions along all watercourses for water cleansing and bird habitat.

10. Re-establish understorey vegetation for Mallee Box *(Eucalyptus porosa)* Open Woodland on steeper hillslopes within the Para Escarpment gullies.

11. Survey major wetlands to determine reedbed effectiveness for optimal cleansing of stormwater to Class A standard. Undertake infill planting on an experimental basis and monitor results.

12. Create a biodiversity inventory of minor (non-ASR) wetlands throughout the City of Salisbury to determine which bird, frog and reptile species utilise and breed at these wetlands.

13. Protect and monitor the vegetation communities of the ephemeral wetlands (Vernal Pools) located adjacent Elder Smith Drive, Parafield Airport.

Site by site action plans detailing proposed rehabilitation or restoration works are currently under construction.

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fig 1 Biodiversity Corridors in the City of Salisbury

fig 2 Biodiversity Condition of Sites in the City of Salisbury

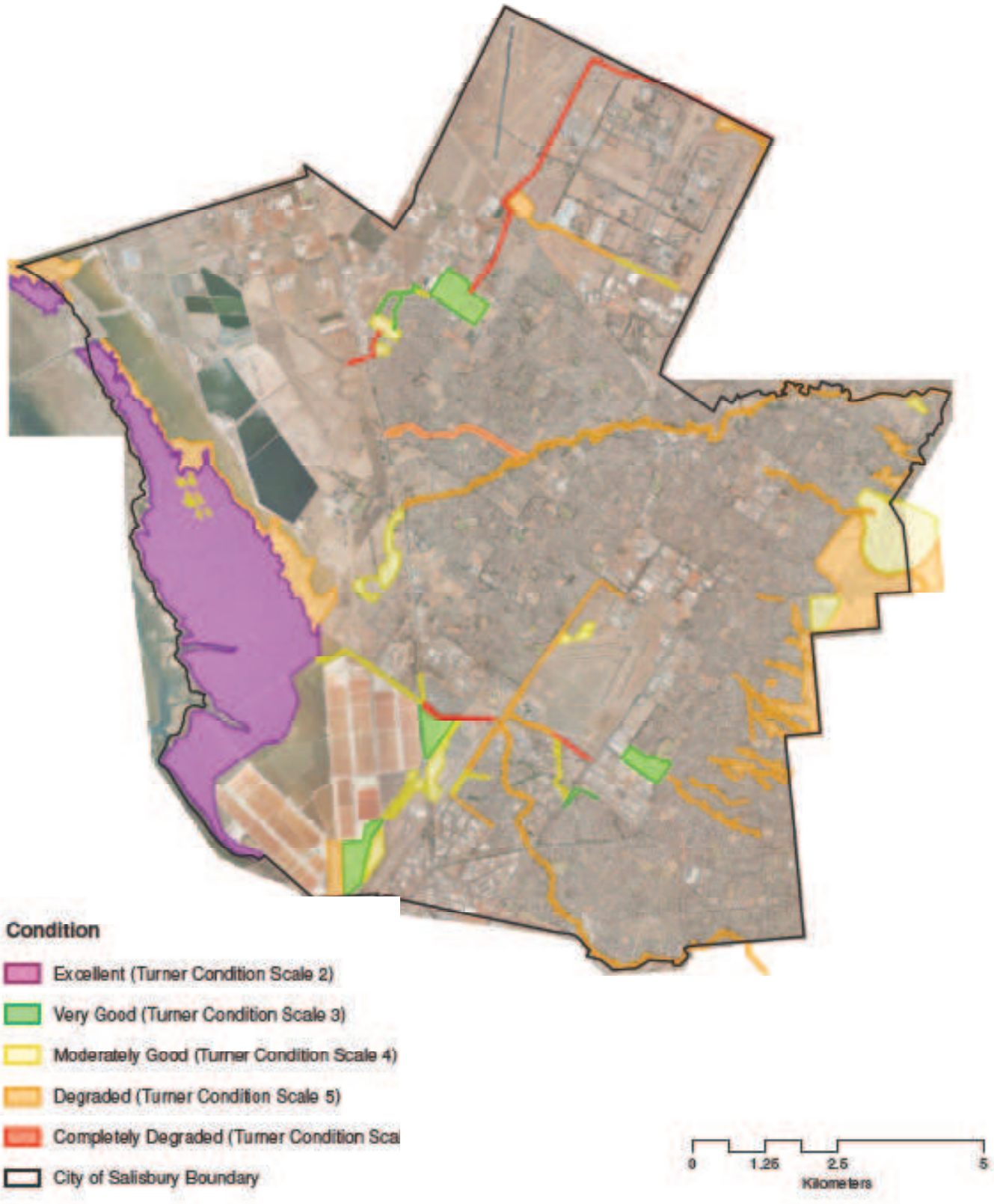


fig 3 Pre-European Plant Communities

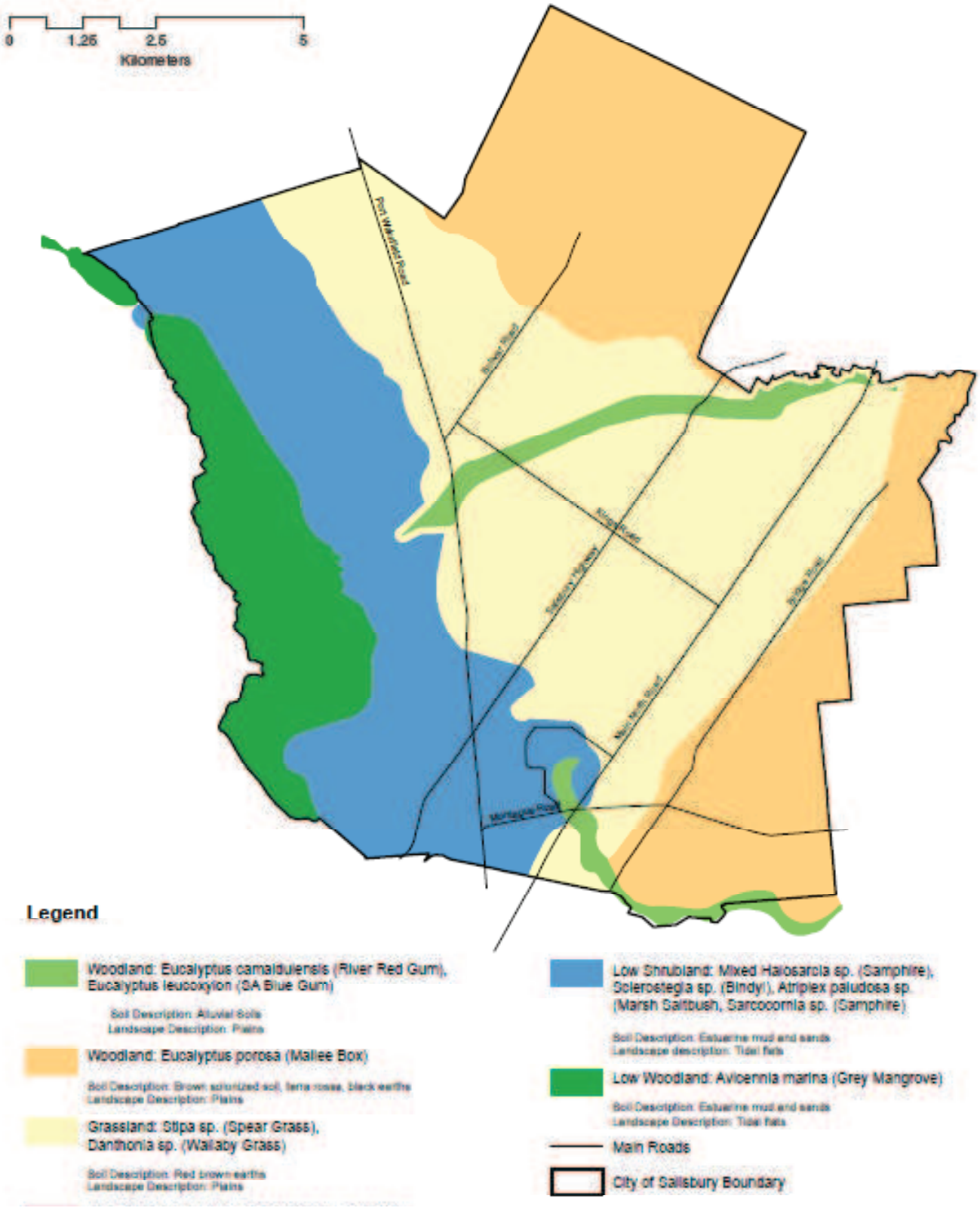


fig 4 Remnant Vegetation in the City of Salisbury

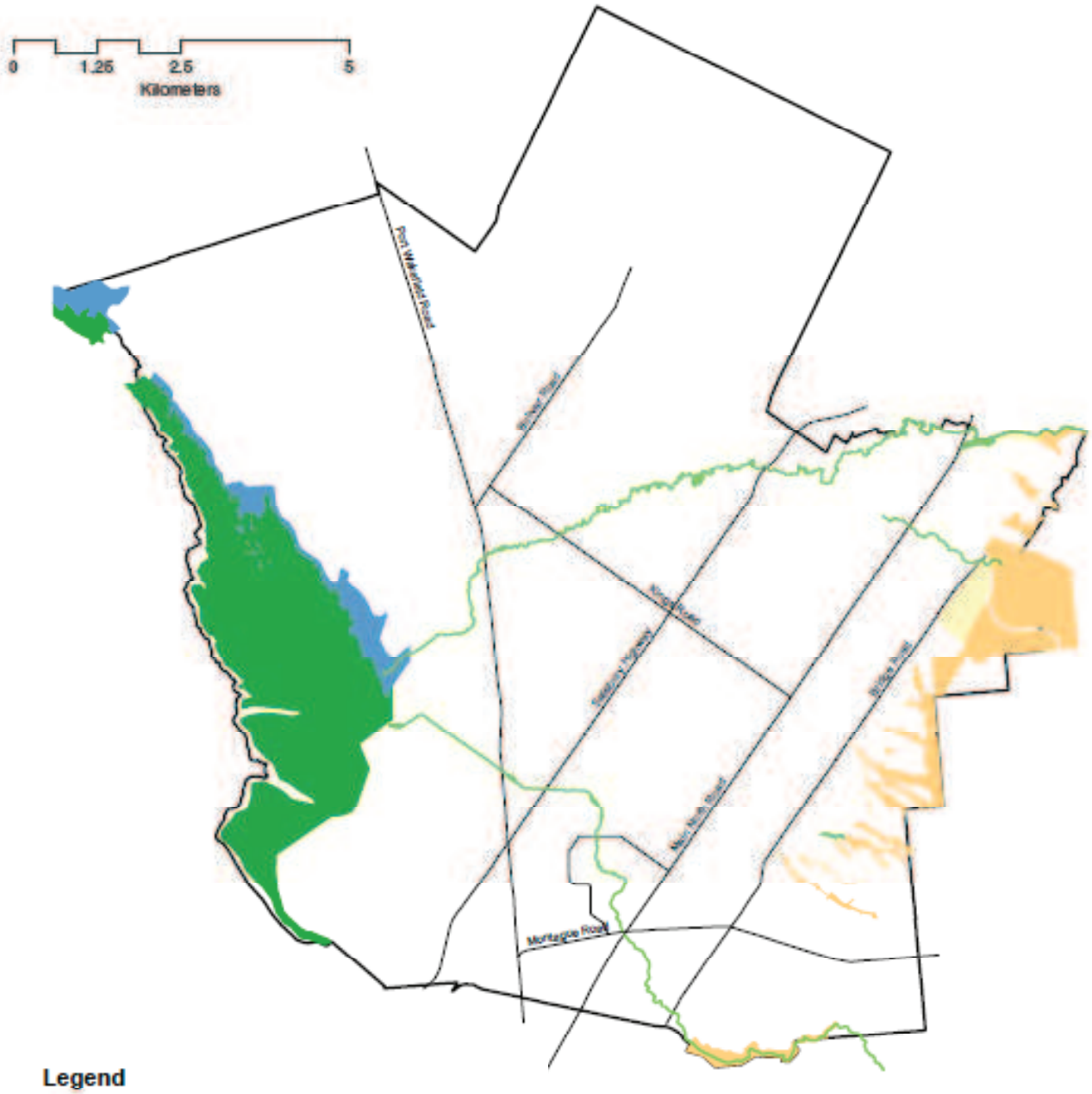


fig 5a Biodiversity Enhancement of Little Para River Corridor

fig 5b Biodiversity Enhancement of Little Para River Corridor

Grassland: Stipa sp.

Potential Woodlot Sites

Woodland: Eucalyptus camaldulensis

Woodland: Eucalyptus porosa

fig 5c Biodiversity Enhancement of Little Para River Corridor

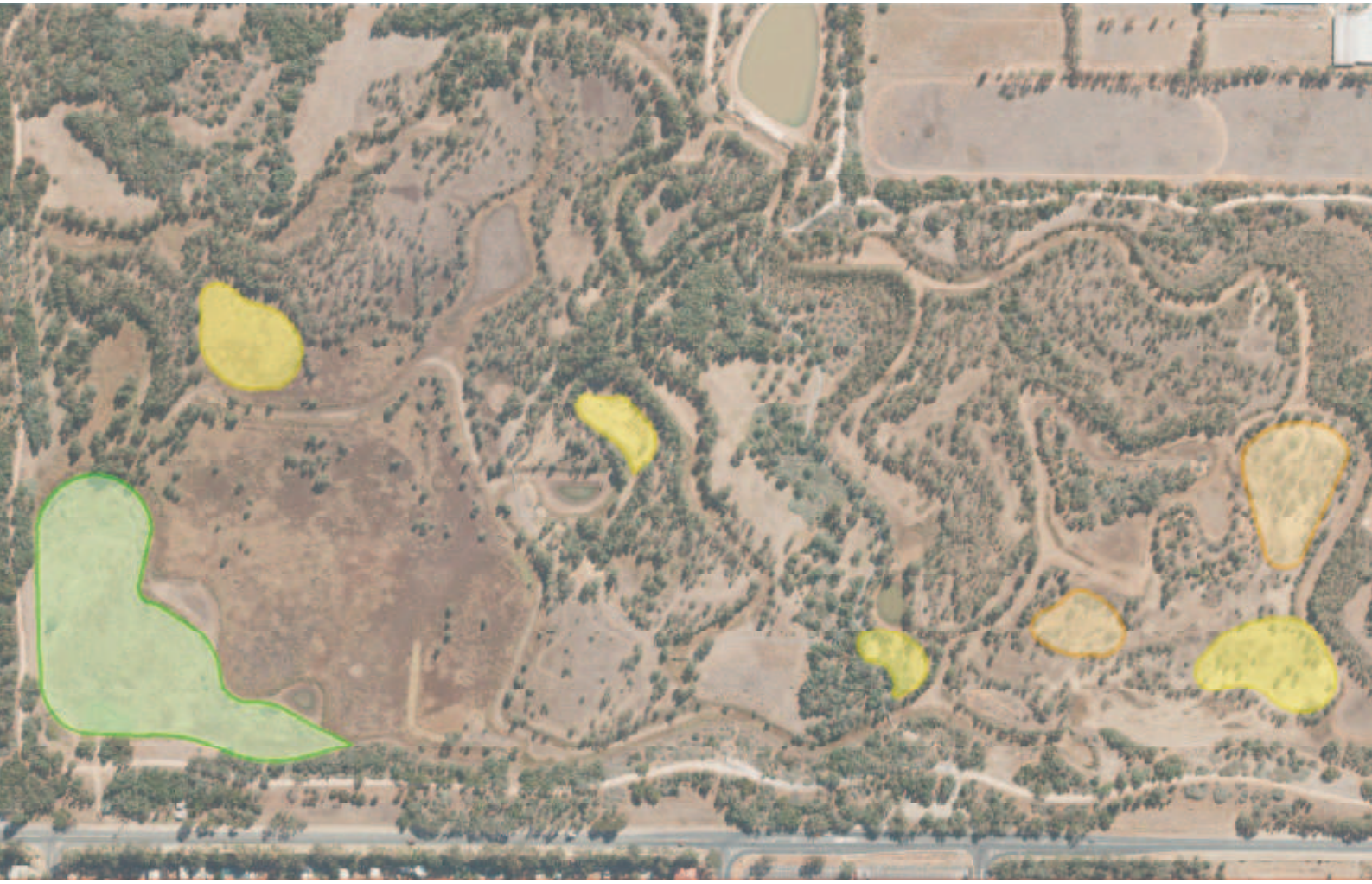
Grassland: Stipa sp.

Potential Woodlot Sites

Woodland: Eucalyptus camaldulensis

Woodland: Eucalyptus porosa

fig 6 Infill Planting Plan Kuarna Park Wetland



Extensive reed bed of Phragmites australis (Common Reed) etc for Water Cleansing

Gahnia filum Tussockland as Seed Source for Grain Eating Birds

Ligrum (Muehlenbeckia Rouliente) Shrubland for Small Bird Habitat

fig 7a Biodiversity Enhancement of Dry Creek Corridor

Grassland: Stipa sp.

Reedbed Restoration

Potential Woodlot Sites

Woodland: Eucalyptus camaldulensis

Woodland: Eucalyptus porosa

fig 7b Biodiversity Enhancement of Dry Creek Corridor

fig 7c Biodiversity Enhancement of Dry Creek Corridor

Grassland: Stipa sp.

Reedbed Restoration

Potential Woodlot Sites

Woodland: Eucalyptus camaldulensis

Woodland: Eucalyptus porosa

fig 7d Biodiversity Enhancement of Dry Creek Corridor

fig 8 Proposed Establishment of Blue Wren Habit Zone

Proposed establishment of native grasslands and woodlands along the Little Para River Corridor between Port Wakefield Road and Kings Road, Paralowie.

fig 9 Proposed Establishment of Blue Wren Habit Zone

Proposed establishment of native grasslands and woodlands along the Little Para River Corridor between Kings Road and Burton Road Paralowie.

Woodland: Eucalyptus camaldulensis (0.70 ha)

Grassland: Stipa sp. (6 ha)

Blue Wren Habit Zones

River System

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E city@salisbury.sa.gov.au W www.salisbury.sa.gov.au

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Salisbury