

Flying-fox Campsite Management Plan

Yarra Bend Park



Flying-Fox Campsite Management Plan Yarra Bend Park

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Summary

Managing flying-foxes is a key challenge facing the broader community of Greater Melbourne and organisations responsible for major parks, gardens and wildlife. The Grey-headed Flying-fox (Pteropus poliocephalus) is listed as threatened in Australia and Victoria, however, increasing numbers have had an impact on Melbourne's culturally and historically significant Royal Botanic Gardens.

In 2003, Melbourne's flying-foxes were relocated from the Gardens and formed two new colonies; the main colony is located at Yarra Bend Park, 5 km north east of Melbourne's Central Business District, and the other smaller colony is at Eastern Park in Geelong, approximately 60 km south of the city. The State Government, in consultation with the land manager, subsequently made a decision to consolidate the Melbourne colony in Yarra Bend Park and, at the same time, minimise any potential impacts on residential areas and commercial operations and increase community understanding and appreciation of the Grey-headed Flying-fox.

This Plan outlines the current situation and sets out a series of goals and actions to implement the Government's decision. It was prepared by consultants working closely with staff from the Department of Sustainability and Environment and Parks Victoria, with input from the Yarra Bend Park Trust, a community reference group and the broader community.

The Plan adopts an adaptive approach to management so that progress is monitored and actions modified as we learn more about flying-foxes and their interactions in a highly urbanised environment. Effective implementation of the plan is a high priority to help conserve a threatened species while recognising and responding to community needs.

Goals

The following key goals have been developed for the plan.

- 1 Successfully develop a sustainable flying-fox campsite in Yarra Bend Park.*
- 2 Enhance vegetation and other environmental values in and near the campsite.*
- 3 Minimise any negative impacts of flying-foxes on residents and park users.*
- 4 Provide improved visitor facilities at and near the campsite.*
- 5 Increase community understanding and support for flying-fox conservation.*

Actions

Important actions to achieve the goals include:

- Ensure that the colony remains within the specified 26 hectare management area.*
- Implement a major regeneration/revegetation plan throughout the management area.*
- Construct wetlands and artificial roost structures to concentrate the colony in a preferred area on the river flat north of the Bellbird Picnic Area.*
- Take appropriate management actions to minimise any adverse impacts on park users and nearby residents.*
- Construct a viewing platform and develop and install interpretive signs near the campsite, including at the Yarra Bend Golf Course.*
- Install orientation signs.*
- Realign and upgrade walking tracks to the viewing platform and along the river flats.*
- Monitor the size and location of the flying-fox colony and the success of habitat improvements.*
- Continue to work with and inform the local and wider community about flying-fox management.*
- Establish a community-based reference group and continue to liaise closely with councils and other interested stakeholders on flying-fox management.*
- Work cooperatively with the Yarra Bend Park Trust to identify opportunities for promotion, including the Yarra Bend Golf Course.*
- Integrate the campsite into the educational use of the Park.*

1 Introduction

Yarra Bend Park, the largest bushland reserve near the Melbourne Central Business District, has become the main campsite in Victoria for the Grey-headed Flying-fox *Pteropus poliocephalus*. This Management Plan has been developed to provide a clear basis for management of the campsite, maximise conservation benefits and minimise possible adverse impacts.

This introductory section provides background information on flying-foxes and describes the management area, policy context and the purpose of the Plan.

The realities of managing a flying-fox campsite in Melbourne

The key realities driving this Plan include:

- The Grey-headed Flying-fox is listed as a threatened species at both the National and State levels and is protected under State and Commonwealth wildlife legislation. The Victorian Government has a legal obligation to assist in the recovery of the species.
- It can be assumed that the Grey-headed Flying-fox is here to stay – Melbourne provides roosting opportunities and a substantial and reliable food resource (DNRE 2001a). Flying-foxes can not be prevented from coming to Melbourne and any attempts to control numbers would be contrary to efforts to recover the species. Therefore, the most appropriate response is to manage the colony to protect it and minimise any impacts on the community and the environment.
- The serious decline in the national Grey-headed Flying-fox population and the increase in numbers in Melbourne is most likely the result of human intervention, such as destruction of habitat in parts of its range (DEH 2003) and the creation of attractive habitats in urban centres. The Melbourne community has an important role to ensure the viability of the population here.
- All wildlife has an impact on its surroundings, including flying-foxes. This impact occurs wherever flying-fox camps are found and is a natural process. Some trees die and others experience varying levels of defoliation as the flying-foxes move about within the canopy. The impact on vegetation caused by flying-foxes is site-specific but is offset by the valuable role that they play in assisting to regenerate our diminishing forests through pollination and seed dispersal (Eby 1995).
- Yarra Bend Park – where flying-foxes began roosting in 2003 – has been identified as one of the most suitable sites for a flying-fox campsite in Melbourne due to its habitat, size, location and other characteristics. The site provides one of the best opportunities in Melbourne to protect and provide for the species while minimising conflicts between flying-foxes and humans.
- In the broad interests of the State, the Victorian Government, in consultation with the responsible land manager, the Yarra Bend Park Trust, has decided to secure the colony at Yarra Bend Park and minimise any impacts.

1.1 Purpose of this Plan

This Management Plan aims to provide a clear framework for managing Melbourne's flying-fox colony at Yarra Bend Park and creating a sustainable campsite. It includes background information on Grey-headed Flying-foxes in Victoria and explains the basis for consolidating the colony at Yarra Bend Park. The Plan also provides a five-year action program with details of the management actions proposed to protect and manage the colony, enhance and promote Yarra Bend Park, minimise impacts of the colony on park users, local residents and the wider community and increase community appreciation and understanding of flying-fox management issues.

1.2 Significance of the Plan

To our knowledge, there are no other examples of the relocation of a flying-fox colony to a new site and its subsequent management to provide a sustainable, permanent campsite. Therefore, this Plan sets an important precedent in the sustainable management of an urban flying-fox camp. It adopts approaches used elsewhere and trials some new initiatives. The Plan adopts a holistic approach to the conservation of this threatened species and its habitats, promoting the co-existence of wildlife and people and providing for education and tourism opportunities.

1.3 A major conservation challenge and opportunity

The Royal Botanic Gardens and flying-fox relocation

The range of the Grey-headed Flying-fox extends along the east coast of Australia, from southern Queensland to Warrnambool in Victoria, and they have been recorded as far west as south-eastern South Australia (Hall and Richards 2000; Menkhorst 1995; Tidemann 1999) (see figure 1). The species is highly mobile (Menkhorst 1995; Tidemann 1999) and the national population is fluid, moving up and down the east coast in search of food. There are no separate or distinct populations of Grey-headed Flying-foxes. The entire Australian population is considered to be one (Webb and Tidemann 1996), with constant interchange and movement between camps throughout their range.

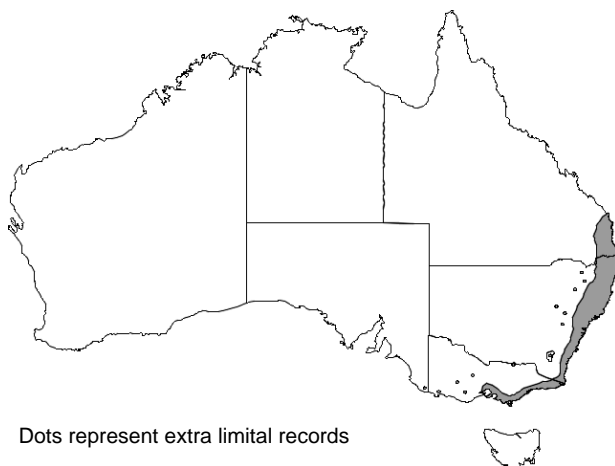


Figure 1: Distribution of the Grey-headed Flying-fox throughout Australia

(Source: Australian Government, Department of Environment and Heritage 2003)

Grey-headed Flying-foxes were first recorded in Victoria in the 1880s and in Melbourne in 1903 (DNRE 2001a). Given the suitable range of vegetation communities occurring naturally in the Melbourne region, there is every reason to believe that the species occurred here long before records were first made by man (Peter Menkhorst, Pers. Comm.) and, thus, are considered to be part of Melbourne's native wildlife.

The distribution of the species throughout its range has been changing over time in response to the changing landscape. The increasing number of flying-foxes in Melbourne is probably in response to an increase in the availability and reliability of food sources throughout Greater Melbourne, the loss and degradation of habitat throughout its range and the heat-island effect, which causes raised temperatures in the city and surrounding built up areas (DNRE 2001a; DEH 2003; Parris and Hazell 2005).

Flying-foxes were first observed in the Royal Botanic Gardens, Melbourne, in 1952 and began roosting there for parts of the year in small numbers in 1981, remaining year-round from 1986 and increasing in number to about 30,000 in 2003. The increasing impact of the flying-foxes on roost vegetation was considered to be unsustainable and threatened significant parts of the Royal Botanic Gardens, which are important to Victoria's cultural heritage (DNRE 2001a).

The trial to relocate the flying-fox colony from the Gardens in 2003 was successful, however, the goal of attracting them to form a colony at a preselected site on the Yarra River at Ivanhoe was unsuccessful, despite careful planning and significant works (DNRE 2002). After much effort, a colony formed in Yarra Bend Park, adjacent to the Bellbird Picnic Area, five kilometres north east of the Royal Botanic Gardens, where it has remained since September 2003. The colony has fluctuated in size, as immigrants join the colony during the regular summer influx, before leaving in winter, when temperatures and food availability declines.

The project to relocate the flying-fox colony from the Royal Botanic Gardens to an alternative site achieved its major goal - no flying-foxes have roosted in the Gardens since April 2003 and there are no animals roosting in any of the inner-city parks or other inappropriate locations. The most affected area of the Royal Botanic Gardens (Fern Gully) is showing signs of recovery and a restoration program is in place.

During dispersal from the Gardens in March 2003, a smaller satellite colony of flying-foxes established a campsite sixty kilometres to the south-west of Melbourne in Eastern Park, Geelong. This colony has fluctuated in number, but has persisted since its arrival. Management actions, separate from those at Yarra Bend Park, will be undertaken to secure the colony at the site. This satellite colony will play an important role in easing the pressure of greater flying-fox numbers in any one location. The presence of the colony in Geelong has been well received by the local community and there has been little conflict with human use and values.

Strategic approach

It is important to adopt a strategic approach to flying-fox management in Greater Melbourne. The number of flying-foxes both visiting and residing in Melbourne has increased significantly over the last 20 years (DNRE 2001a). This trend may continue, posing a challenge to the residents of Melbourne and wildlife management agencies due to the potential for conflict between people and flying-foxes and the complexities that exist due to the species' threatened status.



Establishing a campsite at Yarra Bend Park provides the opportunity to secure the colony in an area where conflict with nearby residents and park users is as little as possible in such a highly urbanised area. Securing the colony in this location will provide protection for other municipalities in Melbourne where there is potential for new campsites to establish. In addition, Yarra Bend Park provides the opportunity to protect and provide for this nationally threatened species.

Any appropriate measures that can be undertaken now, including those outlined in this Plan, may diminish potential conflict in the future.

By improving the ability of Yarra Bend Park and Geelong's Eastern Park to sustain flying-foxes, the pressure of a large population can be distributed between the two sites and potentially avoid the establishment of additional flying-fox campsites at other, possibly inappropriate, locations, should numbers increase.

Government decision to consolidate the colony in Yarra Bend Park and undertake associated improvements

After considering the options available on the future of the colony, and acknowledging the suitability of this site and the difficulty in forming a colony and controlling the movements of dispersed flying-foxes, the Victorian Government, in consultation with the Yarra Bend Park Trust, made a decision to secure the flying-fox colony at Yarra Bend Park in the broad interests of the State.

A commitment of \$1.7 million has been made to develop and implement this Management Plan over five years to ensure that the presence of the colony remains sustainable and to strike a balance between meeting the needs of the community, including users of the Park and local residents, protecting and sustaining the natural values of the Park and providing for the needs of the nationally threatened Grey-headed Flying-fox.

Adaptive planning and management

The Grey-headed Flying-fox has attracted little research effort and its biology, ecology and behaviour are poorly understood, despite the fact that the species generates much public interest (Eby and Lunney 2002). This Plan is based on the best available information at the time and expert experience on flying-fox biology and ecology. A range of important issues, risks and assumptions relevant to the Yarra Bend Park site were identified and considered during the preparation of the Plan.

This Plan must adopt an adaptive management approach, providing flexibility and the ability to respond quickly to changing circumstances as they arise. Through this process, adaptive management allows the making of incrementally better decisions about how to manage the colony.

1.4 Flying-fox management area

Location

The 260 hectare Yarra Bend Park is located on the Yarra River at Fairfield, 5 km north-east of central Melbourne. The Park is about half natural bushland and half developed recreation areas. It extends across two municipalities: Yarra and Boroondara (see figure 2).

Within Yarra Bend Park, a 26-hectare area has been identified for the purpose of managing the flying-fox colony (see figure 3). This management area is located in bushland along the Yarra River in the eastern part of the Park, extending north from a point near the Bellbird Picnic Area and up to the Eastern Freeway. The Yarra River forms the boundary between the municipalities of Yarra (to the west) and Boroondara (to the east) in this area (see figure 2).

The flying-fox colony will only occupy a small part of the 26-hectare management area. Even the largest flying-fox camp seldom occupies more than one hectare (DNRE 2001b). The entire 26-hectare area will be managed to improve habitat values and allow the colony to move about within the site and minimise the impact on any one particular location. The significant habitat improvements delivered as part of this Management Plan will benefit all wildlife that uses that part of the Park.



Figure 2: Park location

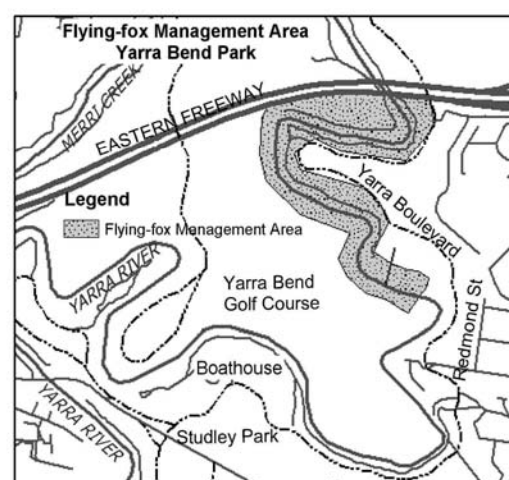


Figure 3: Flying-fox management area

Natural and cultural values and condition

The landscape qualities of Yarra Bend Park make it distinct from other parks in Melbourne (PV 1999). The meeting of the western basalt plains with the Silurian mudstones of the eastern suburbs results in a landscape of dramatic contrasts (PV 1999). The Yarra River is the major focus of Yarra Bend Park. High above the River, dominating cliffs provide commanding views of the city skyline (PV 1999).

Yarra Bend Park is the largest remaining area of natural bushland in inner-Melbourne. The Park is a significant link in the wildlife corridors of the Yarra and Merri Creek valleys, providing an important link in the network of local, regional and national habitat corridors (PV 1999). The Park provides habitat for 193 fauna species, including a number of rare and threatened species. Of these, the Grey-headed Flying-fox is arguably the most significant in the Park.

Approximately 100 hectares of the Park is covered by indigenous vegetation of varying quality (PV 1999). One hundred and seventeen significant flora species are present, 68 being of local importance and 49 of regional importance (PV 1999). Yarra Bend Park has areas of indigenous vegetation of two bioregions: *Victorian Volcanic Plain* and *Highlands-Southern Fall*. There are four vegetation communities represented in the management area:

- Box-Ironbark Forest
- Riverine Escarpment Scrub
- Plains Grassy Woodland
- Floodplain Riparian Woodland

Bellbird Picnic Area
Yarra River

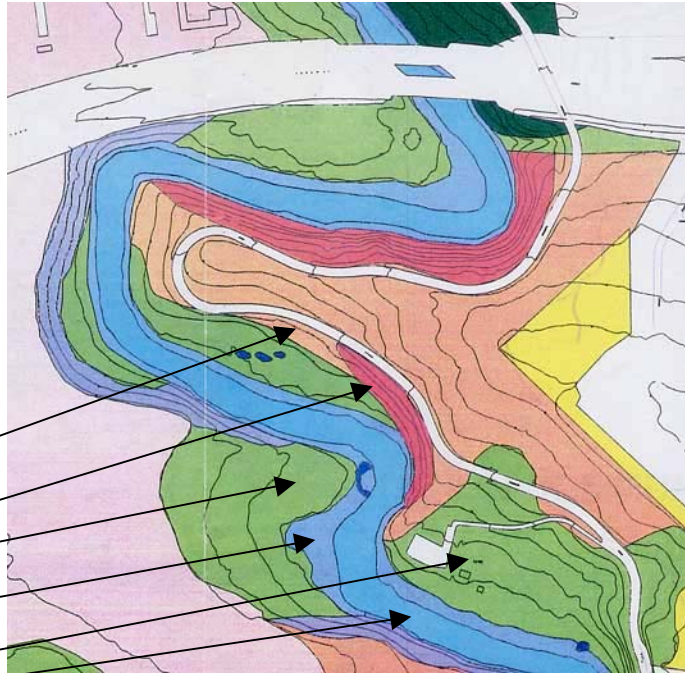


Figure 4: Vegetation communities (source Beardsell 2003)

These vegetation communities are in variable condition, some with high levels of weed invasion and poor regeneration across parts of the management area. Further information on the condition of existing vegetation is provided in section 4.2 and appendix 2.

Tracks in the area are also in variable condition, with those near the river suffering from poor drainage, and steep sections suffering serious erosion, due partly to mountain bike use.

There are no known culturally significant sites in the study area.

Yarra Bend Park is listed on the Register of the National Estate, but this does not provide for special protection or constrain management actions proposed in this Plan.

Detailed accounts of the natural and cultural values of Yarra Bend Park as a whole are available in several reports, including (PV 1999) (PV 2000b) (Beardsell 2003) and at the Parks Victoria website, www.parkweb.vic.gov.au, eg see 'A Brief History of Yarra Bend Park'.

Current uses

Yarra Bend Park is popular for a wide range of recreation activities, including walking, cycling, golf, picnics, canoeing and organised sports. In some areas of the Park, the bushland character provides a sense of tranquillity and the opportunity for seclusion and isolation (PV 1999).

The Bellbird Picnic Area, adjacent to the flying-fox management area, is popular for walking, picnics, nature observation and sightseeing. The majority of the flying-fox management area is little used, with few facilities, and sections of the vegetation are in a degraded state. The area is mostly used by dog walkers and mountain bike riders who are largely confined to the degraded, informal pathways. A narrow walking track, running north west along the river from the Bellbird Picnic Area, is also used by mountain bike riders, although this use is not permitted under the Park's Trails Strategy Plan (PV 2001, p 14).

The colony is also adjacent to limited sections of the Yarra Bend Golf Course, namely the second green and part of the third and sixth fairways, as it stretches along the Yarra River.

Cultural significance and Native Title

The junction of the Merri Creek and Yarra River on the western side of the Park was an important hunting and meeting site for the Wurrundjeri Balluk, the traditional owners of what is now Yarra Bend Park. Aboriginal communities occupied the area for thousands of years before European occupation.

No archaeological sites have been recorded in the management area, however, a cultural heritage assessment will be undertaken before any site development works are undertaken, in accordance with relevant legislation.

The management area is not subject to Native Title claim. Native Title was extinguished in 1935 when a Crown grant was issued to the Trustees of the Park.

1.5 The Grey-headed Flying-fox

The Grey-headed Flying-fox is one of the largest bats in the world, ranging in adult weight from approximately 650 – 1000 grams and with a wing span of up to one metre (Eby and Lunney 2002). It is an intelligent, social animal endemic to Australia and roosts in large camps throughout the year (Eby and Lunney 2002). The species occurs in coastal south-eastern Australia, from south-eastern Queensland to Melbourne, Victoria, and sometimes ranges into South Australia (Hall and Richards 2000; DNRE 2001a) (see figure 1). It was first recorded in Victoria in the 1880s, but is considered to have occurred here long before records were made (Peter Menkhorst, Pers. Comm). The Grey-headed Flying-fox is a permanent resident in Melbourne, feeding throughout the suburbs on a nightly basis (DNRE 2001a; Menkhorst and Dixon 1985).



Flying-foxes roost together in large “camps” during the day, where they rest, socialise and raise young (Hall and Richards 2000). They feed at night and can travel as far as 40 to 50 km from the campsite to feed, with a round trip of as much as 100 km (Eby 1996; KBCS; Parry-Jones and Augee 2001). The Grey-headed Flying-fox is predominantly a nectar/blossom feeder, targeting mainly eucalypt trees and native fruits, which it supplements with introduced plants (Parry-Jones and Augee 1991; Eby 1995; Hall and Richards 2000). The species can move hundreds of kilometres within days or weeks in search of food (Eby and Lunney 2002; Tidemann and Nelson 2004) and have been satellite-tracked moving between Melbourne and Sydney over the period of days (John Nelson, Pers. Comm.).

Flying-foxes benefit forest ecosystems by pollinating plants and dispersing seed, assisting in the regeneration of native hardwood forests and rainforests (Eby 1995; DEH 2003; Hall and Richards 2000).

The national population of Grey-headed Flying-foxes has declined significantly in the last decade, resulting in its classification as a threatened species at both the National (DEH 2003) and State levels. However, while their number is declining, the distribution throughout their range is changing, with a number of camps establishing in urban centres.

Although the Grey-headed Flying-fox has occurred in Victoria for a very long period of time, the number roosting (ie resting and socialising together in camps during the day) in

Melbourne has increased from the dozen or so in the mid-1980s to more than 30,000 at its peak in the summer of 2004. In response to lower temperatures and reduced food availability, numbers decline during the colder months to generally less than half of the summer peak.

The increasing number of flying-foxes visiting metropolitan Melbourne is probably in response to a range of factors, including an increase in its attractiveness and a loss of habitat throughout the northern part of its range. The planting of large numbers of exotic and locally indigenous and native trees from other areas of Australia, including species from Queensland, Western Australia and New South Wales (eg Spotted Gum and Moreton Bay Fig), over the past thirty years has created a new and reliable food resource for the species (DNRE 2001a). However, eight years of below average rainfall throughout much of their range and recent large bushfires in important foraging areas of New South Wales and Victoria may have also influenced the number of animals using Melbourne, as they search for food. Therefore, Melbourne may have already reached its peak number of flying-foxes and numbers could decline as drought eases and burned areas recover from the effects of fire. As evidence, numbers during the peak in summer 2005 fell for the first time in almost twenty years.

There is also some evidence that the "heat island" effect has increased the temperature around the city and inner urban areas, raising minimum temperatures and reducing the number of frosts, making Melbourne more attractive to flying-foxes and providing for their year-round occupation (Parris and Hazell 2005). The artificial watering of city parks and gardens supplements annual precipitation and reduces water stress on plants, making fruiting and flowering more reliable. It could also raise humidity. In combination, humans have increased temperatures and the effective precipitation in central Melbourne, creating a more suitable climate for the Grey-headed Flying-fox (Parris and Hazell 2005).

The carrying capacity of Melbourne for the Grey-headed Flying-fox is currently unknown. Numbers may continue to increase until food or roosting opportunities begin to regulate the population size (Rodney van der Ree, Pers. Comm.). There are abundant roosting opportunities across Greater Melbourne and food availability does not appear to be currently restricting the size of the population. The number of trees and shrubs known to provide food for the species has expanded from thirteen indigenous species prior to European settlement, to more than one hundred species distributed right across Melbourne, providing an attractive and reliable source of food and filling any natural gaps in food supply which may have once occurred (Rodney van der Ree, Pers. Comm.).

The research arm of the Royal Botanic Gardens, Melbourne, the Australian Research Centre for Urban Ecology, has done some preliminary population modelling for the Grey-headed Flying-fox in Melbourne and, as more data become available, models will improve and become more reliable. Current monitoring by the Department of Sustainability and Environment (DSE) will assist in gathering data to develop improved models on flying-fox population dynamics.

Some sections of the community have raised concerns about the presence and number of flying-foxes in Melbourne. However, any efforts to control population growth would be contrary to Commonwealth legislation to recover this nationally threatened species. Also, in practical terms, there is little that could be done to prevent flying-foxes from visiting and residing in Melbourne. Therefore, the most prudent response to their presence is to manage colonies in areas where conflict with humans is reduced. This Management Plan seeks to achieve this goal.

With the knowledge that flying-foxes are likely to always reside in Melbourne, this Management Plan outlines a strategic response to managing for a potential increase in the flying-fox population over time. This may or may not occur, depending on the environmental factors outlined above. Research into flying-fox population size, distribution and other factors will improve our understanding of the species and assist wildlife authorities in appropriately managing flying-foxes, including their campsites. Under this Management Plan, DSE will continue to monitor the camp at Yarra Bend Park and participate in national population surveys.

1.6 Policy and planning context

Legislative requirement to protect flying-foxes

The Grey-headed Flying-fox is listed as threatened under both the Victorian *Flora and Fauna Guarantee Act 1988* and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*. In Victoria, the Grey-headed Flying-fox is protected under the *Wildlife Act 1975*.

A National Recovery Plan for the Grey-headed Flying-fox is currently being prepared by the Commonwealth Department of Environment and Heritage, under the *Environment and Protection and Biodiversity Conservation Act 1999*. The Recovery Plan will outline the research and management actions necessary to prevent the decline and to support the recovery of the species. The aim is to maximise the long-term survival of the Grey-headed Flying-fox in the wild. This Management Plan for Melbourne's flying-fox colony at Yarra Bend Park is considered to be consistent with this objective and seeks to assist in the protection and recovery of the species, while taking into account the needs and views of the broader community.

Park management, policies and plans

A series of Acts, regulations and policies guide the management of Yarra Bend Park (PV 2000b, pp 57-58). The 1999 Strategy Plan is the key overall document and provides important guidance for this site-specific Management Plan (PV 1999, pp 25-26). The Environmental Action Plan (PV 2000b), Vegetation Report (Beardsell 2003) and Trails Strategy Plan (PV 2001) also provide a framework for decision-making for this Plan.

The Yarra Bend Park Trust was established under the *Kew and Heidelberg Lands Act 1933* and is responsible for the management, control and improvement of Yarra Bend Park. Since 1997, Parks Victoria has been contracted to perform the routine, on-ground management of the Park on behalf of the Trust.

1.7 Planning process and consultation

Planning process

This Plan builds on extensive research, investigation and consultation by DSE, including planning for the proposed earlier roost site at Ivanhoe (DNRE 2001a; DNRE 2002) and subsequent investigations of flying-fox ecology and management. Management plans for two campsites in New South Wales were also reviewed during the preparation of the Plan (see CHCC 2004 and KMC 1999).

The Plan was prepared by experienced consultants working with staff from DSE and Parks Victoria, and other stakeholders. Key tasks included a review of issues and options at the site, detailed investigation of existing flora and identification of actions to improve habitat vegetation quality, development of designs for roosting structures, design of wetlands to improve water quality and habitat value, and a review of opportunities to improve visitor access, services and facilities.

The Plan was developed after consulting with key stakeholders.

Consultation and information

An extensive communication process was undertaken by DSE to inform local residents and the wider community about the decision to establish a flying-fox campsite at Yarra Bend Park and seek input into the preparation of this Management Plan.

The process included:

- A media release on the announcement.
- Media (radio, television, newspaper) statements and interviews with the Department of Sustainability and Environment.
- Release of a fact sheet on the announcement. This was put on the DSE website and letter dropped to immediate residents.
- Presentations to interest groups and universities on the proposed draft plan.

- Meetings with regulatory authorities (Melbourne Water, Built Environment, Victorian Communities) regarding legal and planning requirements.
- Meetings with technical experts (landscape designers, surveyors, structural engineers, geotechnical engineers, park managers, biologists, wildlife managers, researchers) to discuss site issues and requirements.
- Meetings and discussions with local residents and commercial interests within the Park.
- Discussions with Aboriginal Affairs Victoria over cultural sites of significance.
- Preparation of a fact sheet to inform the public of the process regarding the preparation and release of the draft management plan. This was delivered to immediate residents, made available in the Parks Victoria Office, Yarra Bend Park, and put on the DSE website.
- Updated FAQs on the DSE website.
- Briefings to the Yarra Bend Park Trust.
- Establishment of a community reference group to consider flying-fox management issues across Greater Melbourne, including the Management Plan for Yarra Bend Park.
- Release of the draft management plan for public comment for 28 days.
- Advertising the release of the draft management plan in local papers.
- The draft management plan was put on the DSE website.
- A major display was erected in the DSE Information Centre in East Melbourne during the month when the draft management plan was open to comment.
- Preparation and availability of a fact sheet on the release of the draft management plan for comment.
- Delivery of copies of the draft management plan to immediate residents and interested stakeholders.
- At the release of the draft management plan, an information session, open to the general public, was held in Bellbird Picnic Area, Yarra Bend Park.

Submissions to the draft management plan were considered by DSE and the community reference group when finalising the Plan.

2 Issues

2.1 Issues

A range of issues was reviewed in the preparation of this Plan, including:

The threatened status of the species at a State and National level:

- Grey-headed Flying-foxes will always be a part of Melbourne's wildlife – we need to accept this and manage the species responsibly and strategically.
- Flying-foxes will have an impact on vegetation irrespective of where colony is located. These impacts are highly localised and more than offset by the role that the species plays in broad-scale forest regeneration.
- The decision has been made to maintain the colony in Yarra Bend Park and provide ongoing protection of the Royal Botanic Gardens.
- The number of flying-foxes in Melbourne will fluctuate in response to environmental conditions throughout its range and may continue to increase over time.
- The attraction of flying-foxes to urban centres is the direct result of human activity (habitat loss outside urban areas, urban expansion into historic flying-fox habitats, attraction into urban centres through changing microclimates and abundance of food sources (DNRE 2001a; DEH 2003; Parris and Hazell 2005).

Other issues:

- Issues surrounding flying-fox management, including their threatened status and conflicts with humans, present a challenge for the broader community and requires a community response.
- The need for stakeholder/community consultation, inclusion and information.
- The need to complement park management plan goals and directions.
- The development of part of Yarra Bend Park provides the opportunity to improve Park values and visitor facilities in and near the roost area.
- Public access to the roost area needs to be maintained, but managed.
- The presence of the flying-fox colony in the Park provides tourism potential, particularly the spectacle at dusk as thousands of flying-foxes leave the camp at night to feed throughout the suburbs of Melbourne.
- The need for increased community knowledge and understanding of flying-fox management.
- Responsibility and funding for implementation of the Plan and ongoing management.
- Managing potential impacts and risks.

2.2 Risks and assumptions

Two important risks have been identified relating to the management of flying-foxes in the Park's highly urbanised setting:

- Should efforts to secure the colony at Yarra Bend Park fail, it could relocate to an inappropriate location, such as back to the Royal Botanic Gardens or into surrounding residential areas.
- The campsite may not be sustainable in the long-term, unless active management is undertaken.

This Plan has been developed with the following assumptions:

- The identified management area will remain sustainable as a flying-fox campsite.
- Impacts of the colony on park users and nearby residents remain at a minimum.
- The State Government continues to support maintenance of the campsite in the Park.

3 Vision, principles and key goals

3.1 Vision for the campsite

In 2009, the flying-fox colony at Yarra Bend Park is widely accepted as a successful example of wildlife management in an urban environment. The management area provides a safe and secure location for flying-foxes and potentially detrimental impacts on the Park have been ameliorated by extensive vegetation works and the provision of wetlands and artificial roost structures. The local community and park visitors have an improved understanding of the role, importance and threatened status of flying-foxes and recognise the achievement of consolidating the campsite away from the Royal Botanic Gardens, high-density residential areas and other unsuitable sites across Melbourne.

Improved facilities in and near the Bellbird Picnic Area provide for improved informal recreational uses and the campsite has become a popular destination for day visitors, tourists and education groups who appreciate the opportunity to see and learn about an important wildlife species in a natural setting close to a major city.

3.2 Principles guiding the Plan

A set of principles was developed to guide preparation of the Management Plan.

- *Protection of Royal Botanic Gardens, and other areas across Greater Melbourne*
Successful consolidation of the flying-fox colony at Yarra Bend Park is of strategic importance and will make a major contribution to the protection of the Royal Botanic Gardens and other inappropriate potential campsites around Melbourne.
- *Cooperation*
The project is to be implemented in close cooperation with the Yarra Bend Park Trust, Parks Victoria, local municipalities and other key stakeholders. Planning is to complement the Park 1999 Strategy Plan.
- *Environmental*
The flying-fox population will be protected and improvements made to the overall vegetation quality and habitat of the management area within Yarra Bend Park (with reference to park vegetation and environmental plans). Improvements will be in keeping with the character of the Park.
- *Community/access*
Community appreciation for flying-foxes will be increased through education and interpretation; access to the site will be retained and tracks and visitor facilities improved (with reference to the Park Trails Strategy).
- *Risks*
Risks to natural values, public health, animal welfare, private property and public liability will be identified and/or minimised.
- *Management*
An adaptive, flexible approach to management will be adopted with effective, ongoing monitoring and management of flora and fauna.
- *Resources*
The State Government has committed \$1.7 million to prepare and implement the Management Plan over a five-year period.

3.3 Key goals of the Plan

The following key goals were developed for the Management Plan. Actions to achieve these goals are discussed in detail in section 4.

- 1 Successfully develop a sustainable flying-fox campsite in Yarra Bend Park**
- 2 Enhance vegetation and other environmental values in and near campsite**
- 3 Minimise any negative impacts of flying-foxes on residents and park users**
- 4 Provide improved visitor facilities at and near the campsite**
- 5 Increase community understanding and support for flying-fox conservation**

4 Actions to achieve goals

This section outlines background information and lists actions to achieve the five key goals.

Details of proposed site works, wetland development, roost structures and a viewing platform are shown on figure 5.

4.1 Goal 1: Successfully develop a sustainable flying-fox campsite in Yarra Bend Park

As discussed in section 1, the State Government has made a commitment to enhance the roosting area at Yarra Bend Park to maximise the probability of flying-foxes continuing to use the identified management area as their major Melbourne campsite. This will help to achieve the strategic goal of preventing roosting in the Royal Botanic Gardens and other inappropriate sites around Melbourne.

Planning for the site aims to provide a core area for the colony, keeping it to the centre to northern part of the management area, away from residential areas and other areas of high recreational use.

Critical to securing the long-term occupation of the colony will be the ability to ensure that the management area remains sustainable as an attractive roost site. It must provide sufficient, sustainable roosting opportunities, a comfortable microclimate and be protected from significant disturbance.

Within Yarra Bend Park, the colony will be contained to the identified management area.

Wetlands and roost structures

Experience to date indicates that flying-foxes prefer roosting sites adjacent to water sources, such as rivers, creeks and wetlands (Hall and Richards 2000). It is therefore proposed to provide additional wetlands near the present roosting areas, particularly on the river flats north of the Bellbird Picnic Area (figure 6). This will be a significant action to attract the colony deeper into the management area and away from residential areas and areas of high use in the Park. It will also help to concentrate the colony in a preferred area and limit impacts on vegetation.



Currently, several outfall drains from the Yarra Boulevard carry runoff into the site before draining into the Yarra River. The installation of a series of interconnected ponds to form a wetland will help remove pollutants, benefit the flying-foxes by providing cooling air currents during hot weather, and provide a greater diversity of habitat (see figure 6 and appendix 1).

The wetland will be carefully designed and constructed to minimise impacts on existing indigenous vegetation, particularly trees, and expand the small existing wetland area located on the flats (photo, above), helping to restore an ecosystem largely lost along much of the Lower Yarra. The wetland will be constructed in existing open spaces and will seek to retain all trees that provide roosting opportunities. Access and construction may require sapling trees and some ground storey to be cleared.

The wetland will be constructed taking into consideration best practice design guidelines developed by Melbourne Water and Environment Protection Agency (EPA) for urban stormwater. In addition to physical design factors (eg catchment size, site soil characteristics, hydrology, safety etc.), water input issues, such as pollutants from road runoff and organic matter, will be considered. Flying-foxes will contribute additional nutrients to the system (Pallin 2000) and this has been taken into account during design and plant selection. Appendix 1, 'Wetlands Area Concept Plan', provides a detailed account of the wetland

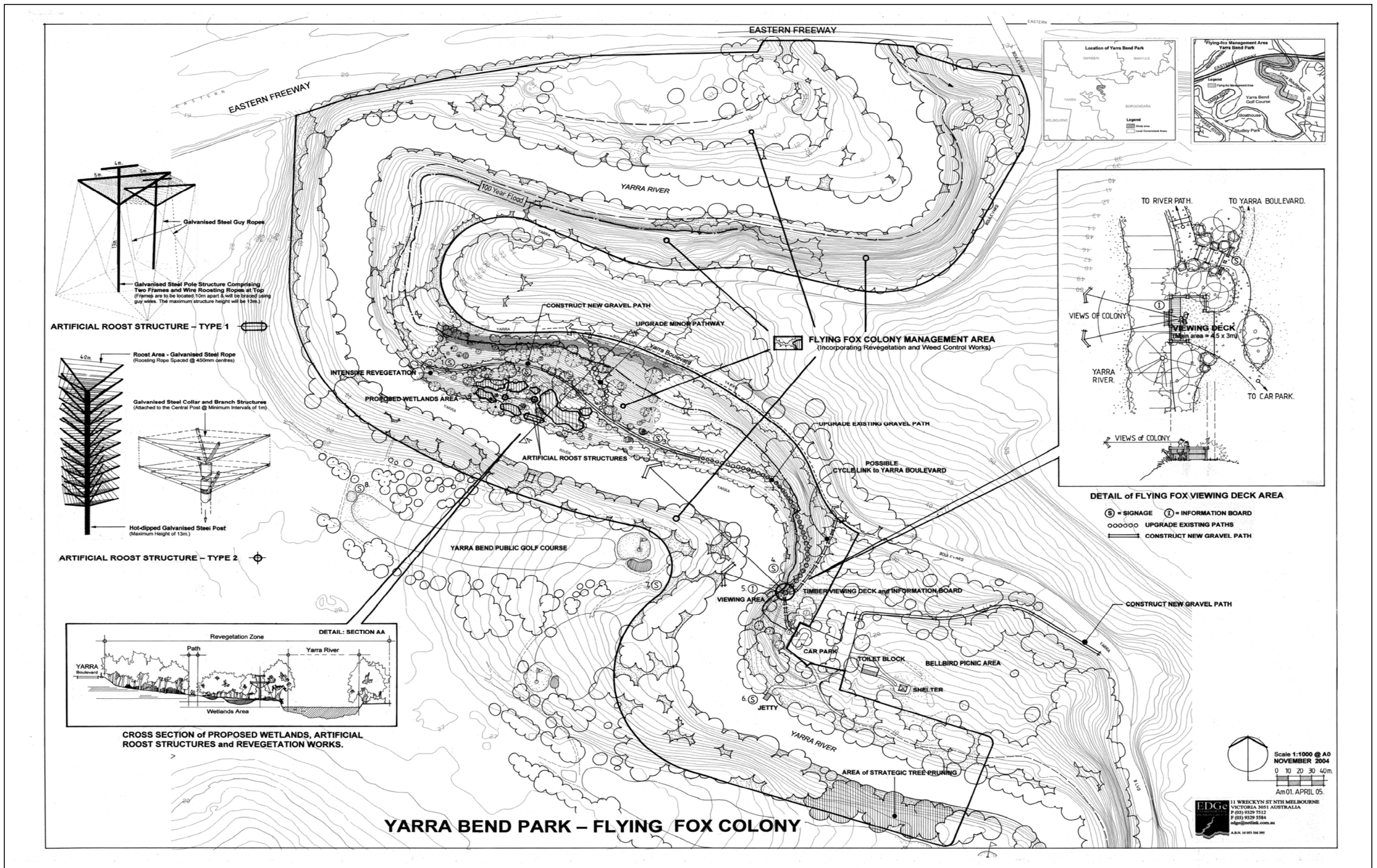


Figure 5 Site Masterplan

design, layout, configuration and planting list. The responsible drainage authority must agree upon final design. Construction of an additional wetland in the north of the management area, near the Eastern Freeway, may be considered in future, depending on the outcomes of initial wetland construction. This area will be revegetated, with care not to disturb any existing significant local indigenous vegetation.

Artificial roost structures are also proposed near the wetland (see figure 5) to provide additional roosting opportunities, concentrate the colony in a preferred area and reduce the pressure on existing trees. The concept for the structures has been developed by flying-fox experts and designed by structural engineers, taking into account the needs of the animals and meeting safety and engineering requirements stipulated by Melbourne Water with respect to withstanding flood flows. Issues considered in the design included: safety and security for both park users and the flying-foxes; visual impact; installation requirements; longevity; attractiveness and functionality to flying-foxes.

Two designs will be trialed, one resembling lines between two telephone poles (see figure 5, artificial roost structure – type 1) and the other an artificial tree (see figure 5, artificial roost structure – type 2). They will be constructed from galvanised steel and/or timber, approximately fifteen metres tall and secured with concrete pads and guy wires. The structures will be located close to the river and artificial wetland, consistent with the preferred roosting locations, and will not be visually dominant. Revegetation efforts will assist in replacing any vegetation lost during the construction process and screening these structures from either the Yarra Boulevard and Yarra Bend Golf Course.

This component of the project is experimental. There is only limited information available on the roosting preferences of flying-foxes. The installations at Yarra Bend will be the first trialed in Australia. If successful, further installations may follow.

Wetland and artificial roost construction works need to be undertaken when the colony numbers are low, ie. prior to the major influx of immigrating flying-foxes in late summer, and care taken not to displace roosting animals or interfere in the early stages of rearing young. Major disturbance to the colony when at its peak could result in part or all of the colony relocating to other sections of the Park or dispersing to nearby residential areas or back to inner-city parks and gardens. Consideration will be given to night-time construction if large numbers of animals pose a logistical problem. Good access to the river flats during construction is available via an old access track from Yarra Boulevard (now closed to the public). Little maintenance of wetlands and roost structures will be required once established.

Other tasks and responsibilities

Consolidation and long-term sustainability of the campsite requires substantial vegetation works (goal 2) and regulation of visitor access to minimise potential adverse impacts on the flying-foxes (goal 4).

All vegetation works will be aimed at enhancing local indigenous vegetation and working within the existing Ecological Vegetation Classes.

Responsibility for funding, construction and ongoing maintenance will be formally agreed between DSE and the Yarra Bend Park Trust, via a memorandum of understanding. Implementation of the Plan will be funded by the State Government and take place over a five-year period. A DSE project officer will manage the development and implementation for the first two years and Parks Victoria will then assume responsibility for implementation and ongoing maintenance at no cost to the Yarra Bend Park Trust.

All structures (eg. pathways, wetland, viewing platform, signage), except artificial roost structures, will become assets of the Yarra Bend Park Trust, which will be responsible for maintenance following installation. DSE will retain responsibility for the ongoing maintenance of artificial roosts.

Prior to the end of the five-year management plan, a strategy will be prepared for the continued management of the flying-fox colony in Yarra Bend Park.

Adaptive management

The actions proposed in this Plan to consolidate the existing roosting site are based on the best information currently available. However, flying-foxes and the Park are part of complex natural systems which can behave in unpredictable ways. It will be essential to constantly monitor the stability of the colony and the outcomes of the management actions proposed in this Plan, and be prepared to adapt and respond to changes as they occur.

A monitoring program will be conducted to identify the size and location of the colony. The monitoring program will also investigate recruitment and other aspects of the camp. Further monitoring will be conducted to measure the success of revegetation works.

Any new campsites that may develop in or near Melbourne will also be monitored and appropriate management actions developed and implemented.

Measure of success

The success of the site will be measured by its ability to function as a successful and sustainable flying-fox campsite. The number of animals in the roost at any one time will only become an issue should the sustainability of the site be compromised or impacts on people reach an unacceptable level.

The flying-fox community reference group will be engaged to assist in the development of criteria to assess the impact of the flying-fox colony on the broader community. Factors to consider will include the nature and extent of any impacts on residents and the number affected, the nature and extent of any impacts on park values and park users, the benefits to the broader community of managing the colony at Yarra Bend Park, the consequences should the colony establish at another location and its potential impact on communities elsewhere. All of these factors should then be considered against the implications for the conservation of this nationally threatened species and the legal requirements of the State to protect and assist the recovery of the Grey-headed Flying-fox. The reference group will also be consulted over possible measures to minimise any adverse impacts.

The Plan has been developed with the knowledge that flying-fox numbers using the site may increase over time. Major revegetation efforts and ongoing management throughout the 26-hectare management area will improve the habitat quality and provide an abundance of future roosting opportunities, despite the loss and degradation of some overstorey trees through defoliation. It is intended to make the majority of the management area useable to flying-foxes. This will allow the colony to move its roost around within the site, thereby limiting its impact on any one particular area (Hall 2002; Hall and Richards 2000; Pallin 2000). This will also cater for any potential increase in the size of the colony.

Detailed monitoring will be undertaken to guide management of the site. This will include frequent counts of the number of flying-foxes, mapping the location of the colony within the management area and assessments of recruitment. Several animals have been fitted with satellite-tracking collars to record the gross movements of flying-foxes as they move throughout coastal eastern Australia. Habitat quality will also be monitored to assess flying-fox impacts and the success of vegetation management practices.

This monitoring will provide valuable information on the performance of management actions and provide for informed review of the approach. It will also provide valuable information for wildlife management authorities charged with managing flying-fox colonies in urban settings.

Management actions

- 1. Formalise the responsibilities of DSE, the Yarra Bend Park Trust and Parks Victoria for implementation and ongoing management and funding responsibilities for the flying-fox management area.**
- 2. Conduct an extensive revegetation/regeneration and weed control program throughout the management area and construct a wetland and artificial roost structures at sites shown on the masterplan (figure 6), in accordance with approved engineering specifications. Ensure minimal impacts on roosting flying-foxes during construction and maintenance. Employ an expert observer during excavations to identify any sites or artefacts of cultural significance**
- 3. Undertake ongoing monitoring of the flying-fox colony and campsite and adapt management practices in response to changing circumstances. Include fortnightly colony counts and mapping, annual assessments of the success of habitat improvements and the impact of the colony.**
- 4. Ensure that the colony remains in the identified management area.**
- 5. Towards the end of the five-year management plan, prepare a strategy for the continued management of the flying-fox colony in Yarra Bend Park.**

4.2 Goal 2: Enhance vegetation and other environmental values in and near the campsite

This section summarises work undertaken by Practical Ecology Pty Ltd to assess existing vegetation and devise a plan to regenerate and revegetate the management area to provide abundant future roosting opportunities and improve habitat and vegetation quality (attached as appendix 2).

Only local indigenous plant species consistent with local Ecological Vegetation Classes (EVC) will be used. This will help to create an attractive and sustainable flying-fox campsite while increasing habitat complexity and benefiting other wildlife (Pallin 2000) that use this part of the Park.

Over time, the work will provide significant roosting opportunities so that the colony can move around within the management area. This will minimise the impact on any one particular site (Hall 2002; Hall and Richards 2000; Pallin 2000). Although the presence of the colony will have an impact on roost trees, resulting in some losses, this Vegetation Management Plan will produce an overall net gain to vegetation and improve biodiversity values.

Existing vegetation

The existing vegetation throughout much of the management area is disturbed as a result of long-term pressure from grazing, weed infestation, habitat fragmentation and recreational development and use.

Upper canopy coverage is dominated by River Red Gums and is generally healthy, although patchy in places, particularly where flying-foxes are roosting continually. Throughout much of the management area, there is little evidence of recent regeneration or establishment of the upper canopy due to smothering and competition by the weedy ground cover. Intermediate-aged saplings are rare and isolated to a few coppices and generally inadequate to replace the mature trees. There is evidence of ongoing upper canopy die-back, the cause of which is unknown. However, recent drought, possum browsing, insect attack and, more recently, Grey-headed Flying-fox roosting, may be contributing.

Defoliation and the loss of some upper canopy trees is a natural process associated with the presence of flying-fox campsites (Hall and Richards 2000; Hall 2002). This loss is expected and the vegetation strategy aims to compensate for any loss. As different aged trees mature, they will replace current trees and provide more roosting opportunities.

The middle canopy vegetation is open and sparse, as characteristic of the site's EVCs, however, this is exaggerated through a lack of recruitment due to the weedy ground cover. The ground storey vegetation of low-lying, wetter areas is highly infested with grassy weeds (photo, right).



With the exception of some intact, high quality fragments (eg Hairpin Bend), overall, the management area has a relatively low biodiversity value and the regeneration/revegetation works proposed in this Plan will greatly increase habitat complexity and provide more favourable conditions for a range of birds, mammals, reptiles and insects (Pallin 2000).

Flying-fox impacts

The Management Plan will improve the overall conservation values of the site through increased habitat complexity and the return of the mostly absent mid-storey and ground cover. Therefore, it is considered that wildlife species of local interest will not be significantly adversely impacted (DNRE 2001b). From studies elsewhere, there is no evidence that flying-fox colonies have a deleterious effect on most species of native birds (DNRE 2001b), although some species may be excluded

from using the part of the campsite where flying-fox densities are greatest.

It is considered that there is ample habitat for territorial species, such as the Bell Miner, along adjoining sections of the Yarra River. Arboreal mammals, such as gliders and possums, have been recorded as resident within flying-fox campsites elsewhere (Pallin 2000). Flying-foxes depart the roost at night to feed when these nocturnal species are active.

The impact on hollow-nesting birds, such as parrots, is not considered to be significant (DNRE 2001b). Both Rainbow and Musk Lorikeets have been observed nesting in roost trees in the campsite at Yarra Bend Park (Simon Toop, personal observation). Some predatory (Hall and Richards 2000; Pallin 2000) and hollow-nesting bird species and hollow-nesting mammals may actually benefit from the presence of the colony through the provision of a source of prey and the creation of hollows. Site rehabilitation works throughout the 26-hectare management area are expected to improve the quality of habitat for invertebrates, reptiles, amphibians and shrub layer birds and, in the longer term, hollow nesting species (DNRE 2001b; Pallin 2000).

The Yarra River valley is the most important wildlife corridor in inner-Melbourne, largely due to the movement of birds and native fish (DNRE 2001b). This corridor linkage will not be impacted. Given the flying-fox colony will not have deleterious effect on most resident birds, it will be even less likely to impact on migratory species (DNRE 2001b). There is ample scope beyond the area of the campsite for the dispersal of birds along the river valley and the colony itself would not be a significant barrier (DNRE 2001b). There are already numerous larger gaps in the corridor caused by land clearing and development along sections of the River that birds pass through (DNRE 2001b). Replanting native vegetation will improve the corridor properties of the region.

Flying-fox excrement will increase nutrient levels under roost trees (Pallin 2000), although most defecation takes place within twenty minutes of eating and away from the campsite at feeding places (KBCS). Higher nutrient levels may affect indigenous vegetation, however the increased density of plants resulting from a significant revegetation program will result in an increased uptake of nutrients. It is not practicable to physically remove excrement. Planting species able to tolerate increased nutrient levels may be a future option.

An issue frequently raised regarding flying-fox campsites in close proximity to waterways is the impact on water quality. This issue is often overstated and experience both in Melbourne, at the Royal Botanic Gardens, and throughout their range in New South Wales and Queensland, where the bulk of the population occurs, suggests has little basis. As an example, testing of the Coffs Creek (NSW) in 2004 at sample sites above and below the flying-fox colony showed no difference in water quality, including levels of nitrates, phosphates and *E. coli* (CHCC 2004).

Similar claims of impacts on waterways have been directed at the much smaller microbats that can live on structures overhanging water bodies. Again, studies have shown that there is no adverse impact on water quality. As an example, 1.5 million Mexican Free-Tailed Bats (*Tadarida brasiliensis*) roost under the Congress Bridge in Austin, Texas, United States of America. Two separate studies conducted by the City of Austin and the Lower Colorado River Authority investigated the impact of the colony on the water quality of the river below the bridge. Both studies showed no problems to water quality, including physical parameters, nutrients and biological characteristics, including faecal coliform bacterial counts (Keeley and Tuttle 2000).

It is common for flying-foxes to roost adjacent to rivers, creeks and wetlands (Hall and Richards 2000). Nutrients entering waterways from flying-fox camps is a natural phenomenon and likely to have less impact than runoff from the adjacent golf course and pollutants entering the waterways from stormwater runoff from the Yarra Boulevard and elsewhere in the catchment. The increased vegetation at the site resulting from significant revegetation works will progressively reduce runoff into the river and the input of nutrients.

There may be a seasonal increase in the number of Red Foxes in the area, particularly when deaths of flying-foxes are greatest, ie. during the rearing of young and over winter during food and temperature stresses. Red Foxes were previously present at the site and continued ongoing control will be important to limit numbers.

Principles for designing and implementing rehabilitation works

The regeneration/revegetation plan is based on the following principles:

- Creating or maintaining a cool, humid, sheltered environment with abundant roosting trees appropriate for Grey-headed Flying-foxes.
- Providing habitat for the region's indigenous fauna.
- Providing for a net gain of indigenous vegetation.
- Replacing invasive weeds with indigenous species.
- Encouraging the regeneration of indigenous species.
- Ensuring stable, maintainable areas of revegetation/rehabilitation.

Measuring project results: habitat-hectare and additional site assessment

As part of the development of this Management Plan, a 'habitat-hectare' assessment was conducted to measure any impacts that the presence of Grey-headed Flying-foxes may have on the vegetation of the campsite, and to measure the positive effects of the revegetation/rehabilitation program. This assessment will also provide a useful baseline comparison following long-term Grey-headed Flying-fox roosting, site development and the regeneration/revegetation program.

Habitat-hectare assessments rely on the comparison of a remnant native vegetation stand with a standard 'benchmark stand'. Benchmarks have been constructed for each EVC within each Victorian bioregion, as typical measures of what each EVC would be like if in a mature and long-undisturbed state.

In addition to annual habitat-hectare assessments, an alternate monitoring approach will also be used to complement monitoring and assess technique effectiveness. Discussions with experts will determine the most suitable approach, which is likely to involve quadrat sampling.

Target areas for works

Key areas for vegetation management (figure 56) were identified as follows. Specific details are provided in appendix 2.

- Rehabilitation and expansion of the wetland area forming part of the current campsite (east of the River)
- Weed control and selective revegetation across the site

Ongoing weed control across the site is vital to keep invasive weed species in check, to maximise the success of indigenous planting programs, and to allow natural regeneration of indigenous plant species. This Management Plan will allow for expansion of the Park weed control program to include weed species that, though not the subject of legislation, are nevertheless highly invasive and proving to be problematic across the site.

Weed control

Yarra Bend Park's Environmental Action Plan (PV 2000b) documents that 381 exotic plant species have been recorded in the Park, and that of these, 61 weed species are considered to be of particular concern due to their invasive nature. There are 19 species listed as 'regionally controlled', and another 42 are considered to be 'major environmental weeds'.

Field work for this plan involved identifying invasive weeds that require control and determining control methods.

Integrating weed control, regeneration and revegetation

- *Weed control*

Initial weed control will involve:

- (i) the removal or control of ground storey weeds from an area to facilitate the regeneration of indigenous plants; and
- (ii) woody weed control to increase light levels.

After the initial programs, selective weed control by hand weeding and/or spot spraying will be necessary on an ongoing basis.

- *Assessment of regeneration, and design of revegetation*

After the initial weed control program, regeneration will need to be assessed and revegetation density and species determined taking into account indigenous plants on site.

- *Further weed control, and implementation of revegetation*

Any weeds that have regenerated will need to be controlled before starting the planting program. A detailed program of works has been developed for the site.

There will be opportunities for community involvement in revegetation works.

Revegetation templates

Revegetation 'templates', or tables, based on the DSE benchmarks and Beardsell's (2003) floristic survey, have been developed for each bioregional EVC found on-site. Each template provides a list of indigenous species that are appropriate for revegetation within that EVC, and specific planting densities, ie the number of each species/square metre. These templates form the basis for revegetation works. Planting will consist wholly of locally indigenous species.

Management actions

- 6. Implement the program of works identified in the regeneration/revegetation plan, including extensive weed control and indigenous planting as specified in the planting schedules (appendix 2). Construct wetlands to provide increased habitat diversity and treat road runoff.***
- 7. Monitor Red Fox numbers and increase control measures if numbers increase in the management area.***
- 8. Involve the community in clearly identified components of the revegetation work to increase involvement and ownership of the project.***
- 9. Monitor and assess progress and adapt management to ensure successful weed control and regeneration and revegetation.***

4.3 Goal 3: Minimise any negative impacts of flying-foxes on residents and park users

The area identified for management as a flying-fox campsite is located in a little used and relatively degraded section of the Park. It is bounded to the north by the Eastern Freeway, to the east by the Yarra Boulevard and to the west by the Yarra Bend Golf Course. With the exception of the southern end, the management area is surrounded by open space (eg. golf course) or remnant bushland, and provides the opportunity to contain the extent and location of the colony.

Access through the management area is restricted to informal dirt tracks. The area is mostly used by dog walkers and mountain bike riders, even though the Trails Strategy Plan prescribes the trail between the Eastern Freeway and Bellbird Picnic Area as 'walkers only' and bike riding is not permitted in this part of the Park.

Feeding impacts

Satellite-tracking studies shown that flying-foxes fly out from the Yarra Bend Park campsite every night to feed throughout the suburbs. They disperse over a wide area and their movements are dictated by food availability, so impacts are no greater in the urban residential and semi-rural areas surrounding Yarra Bend Park than in other parts of Melbourne (DNRE 2001b).

Flying-foxes are capable of travelling long distances (up to 100 km in a single night) to satisfy nutritional requirements (Eby 1996; KBSC; Parry-Jones and Augee 2001). Residential areas with no sources of food are unlikely to attract flying-foxes, however, those properties that provide a food source (eg. flowering eucalypts) may attract flying-foxes from time to time and their presence may only become noticeable when competing animals squabble over food, leave droppings or take fruit. There is little that can be done to prevent flying-foxes from feeding in trees in residential properties and the animals will leave once the food source is exhausted. Residents with backyard fruit trees can protect their fruit from being eaten by flying-foxes and other wildlife by using appropriate netting structures. To avoid issues related to soiling, residents can adopt measures such as not having washing on the line during the night and moving cars from beneath feed trees.

Flying-foxes can cause damage in orchards which can lead to conflict with producers. However, they usually only target fruit crops during periods when natural sources of food are scarce (DNRE 2001a; Hall and Richards 2000). Around Melbourne, damage has been recorded at orchards around Warrandyte, Yarra Valley and Wandin, on a range of pome and stonefruits. Damage is sporadic and generally only at specific properties, with some targeted by flying-foxes while other nearby properties with the same crop are ignored.

Orchardists around Melbourne have experienced damage from flying-foxes for many years, irrespective of the location of their campsite. The level of damage is influenced by food availability and not the location of the campsite within urban Melbourne (DNRE 2001a). The relocation of the colony five kilometres from the Royal Botanic Gardens will do little to change their feeding range (DNRE 2001b), as this short distance is insignificant considering that flying-foxes can fly up to 100km in a night to feed.

This Management Plan deals specifically with the issues surrounding the sustainable management of the flying-fox colony at Yarra Bend Park. It is not intended to address issues outside those relevant to Yarra Bend Park and the immediate surrounds, such as any impact on the orchard industry. The Commonwealth Government is currently in the process of developing a National Recovery Plan for the Grey-headed Flying-fox and approaches to addressing the issues associated with crop damage are being considered as part of that plan.

Roosting impacts

The flying-fox campsite can, from time to time, have some impacts on the immediate residential area and park visitors.

Conflict can arise as a result of the noise and odour that is generated by the camp. Flying-foxes are particularly vocal during the breeding season (February – May) and as they return to the camp in the early hours of the morning after feeding. At other times, the campsite can be quiet and the flying-foxes go largely unnoticed.

The odour of a flying-fox campsite is not caused by faeces or urine, but rather the scent secreted by the animals. The odour is most noticeable during the breeding season, as males mark their territories, and, to a lesser extent, while young are being raised (October – January) (KBCS). Mothers use scent to locate young in the camp.

Some people object to the noise and smell periodically associated with the colony while others accept it as part of nature. The only action available to reduce the impact of the camp's noise and smell is to maximise the distance between the edge of the colony and residential/high use areas.

There is also a visual impact resulting from the partial defoliation of trees used for roosting, particularly in the core area of the colony where the bulk of the animals occur. Wherever flying-foxes roost, they have an impact on the vegetation at the campsite (Tidemann 1999), even more so at permanent camps, where animals roost year-round. This is a natural phenomenon and part of a natural process. Significant revegetation of the management area will improve the habitat quality throughout the site and help to reduce the visual impact from roosting.



It is important to recognise that flying-foxes have an impact on vegetation wherever they choose to roost. This impact should be put in context when compared to the important role that the species plays in the propagation and ongoing evolution of flora throughout its range (DEH 2003). The Grey-headed Flying-fox is an important pollinator and seed-disperser of native trees and assists with the regeneration of forests which provide for many lifeforms and natural processes (DEH 2003).

- **Residential areas**

The Yarra Bend Park campsite has little to no impact on most residents of surrounding municipalities. With the exception of a very specific concentration of houses, there have been few issues associated with the colony. Depending on the time of year and size of the colony, flying-foxes usually roost at least 250 metres from the nearest property. This is a relatively large distance when compared to other urban camps in Queensland and New South Wales, which can sometimes extend into residential properties. At the Royal Botanic Gardens, the colony was about 200 metres from the nearest residence and few problems were experienced.

That said, close proximity to the campsite can impact on the amenity (noise and odour) of a small number of nearby residents. Impacts can occur when the colony extends southward along the river and to within 150 metres of houses. Residents who overlook the colony may also experience some impact on visual amenity through the partial defoliation of roost trees.

In the early stages of their occupation of Yarra Bend Park, Flying-foxes occasionally gathered in three properties on the edge of the Yarra River and roosted for limited periods, particularly during very high temperatures (40°C and above) or after returning to the camp in the early hours of the night and failing to join the rest of the colony. The resulting noise from concentrations of squabbling flying-foxes has disrupted residents' sleep. However, this has not proved to be a problem now that the colony is well established in a defined area and will continue to be monitored and action taken where problems arise.

Preventing flying-foxes from roosting or concentrating in residential properties is an important priority and DSE will continue to work actively with these residents to achieve this.

Strategic tree pruning

Creating a sufficient buffer and containing the colony between the Bellbird Picnic Area and the Eastern Freeway is seen as the key requirement to minimise any impacts on local residents. This can be achieved by attracting the colony further to the north of the site, through mass tree planting and the construction of wetlands and artificial roosts, and the

selective pruning of a narrow strip of trees along the Yarra River in the very south of the management area to create a physical buffer, preventing the colony from spreading too close to residences in streets that immediately abut the Park. The goal is to maintain a buffer at approximately 250 metres from the closest resident.

Currently, the centre of the colony is located around the wetland on the River's edge below the second hole of the Yarra Bend Golf Course. From there, the colony radiates out along the river, to the north and the south.

The southern section of the colony is restricted to the strip of vegetation between the golf course and the River. This strip narrows along the sixth fairway and forms the southern extremity of the campsite. Here, flying-foxes prefer to roost along the River's edge, however, when densities are at their greatest and river edge roosting opportunities are completely occupied, the colony expands back up the slope and towards the golf course fairway.

At peak densities during summer and early autumn, the colony can spread southwards and to within approximately 150 metres of the nearest residences. This can cause problems, particularly related to noise.

In order to limit the southward spread of the colony to an acceptable distance from residents, a 'barrier' to roosting must be created. This can be achieved by reducing roosting opportunities and breaking the contiguous spread of animals from roosting beyond that point.

Creating this physical barrier will require the strategic pruning or thinning of roost trees along a limited section of the strip of vegetation between the River's edge and golf course at the southern end of the management area (see figure 6). Roost trees will be identified for pruning, however, small trees offering limited roosting opportunity not be pruned. Pruning will be applied to both live and dead trees, however, no trees will be removed. The importance of dead trees as wildlife habitat is recognised.

A conservative approach to pruning will be adopted while seeking to achieve the desired outcome of protecting residents. Pruning will be staged, with a succession of light prunes, if necessary. The effectiveness of each treatment will be evaluated before further pruning is considered. Consistent with sound arboricultural principles and to ensure the continuing viability of the tree, a maximum of one-third of a tree's canopy may be removed.

The flying-fox colony is monitored on a fortnightly basis. The size of the colony is estimated and the extent and location of the colony is mapped, so there is good knowledge on when the colony is encroaching too close to houses. This information, in addition to feedback from Parks Victoria staff and local residents, will be used to determine if and when it is appropriate for pruning to occur.

Pruning will only occur when a problem is experienced. If the colony does not encroach on residential areas, it will not be undertaken. The area identified for pruning has a low density of trees and, as a result, the number to be pruned is small.

The Park managers, the Yarra Bend Park Trust, will be required to endorse any pruning beyond the first initial light prune. This will add a further layer of scrutiny to the process to ensure that only the necessary level of pruning is conducted to prevent the southerly spread of the colony. To reduce any visual impact of pruning, priority will be placed on not treating the trees along the ridge which lines the golf course.

The existing sparse understorey in this section of the management area will be retained and no revegetation efforts will be undertaken. This is in order to make this short section unattractive to flying-foxes as a roosting area.

Pruning has only a short-term impact and, if other measures are successful in attracting the colony to the north of the management area, trees will be allowed to recover. The pruning of trees will not act as a barrier to wildlife and birds and mammals will still be able to move through this zone, as a tree canopy will continue to exist (DNRE 2001b).

Should the problem of the colony roosting too close to residences arise, it will be important to provide an immediate and effective solution. Waiting for improvements (eg. plantings, wetlands and artificial roosts) to draw the colony further to the north of the site is expected to

take at least five years or more and, even then, may not prevent the colony from roosting in this southern part of the management area.

Principles

- The minimal amount of pruning will be used to achieve the desired result.
- The first priority for pruning will be close to the River's edge (the preferred roosting location) then, as needed, back up the slope into the mid-zone (see figure 6). Pruning the trees on the ridgeline will be a last resort.
- Trees will be selected for pruning according to:
 - Roosting opportunities
 - Aesthetics
- Pruning will only be conducted by qualified and professional arborists operating to Australian Standards.

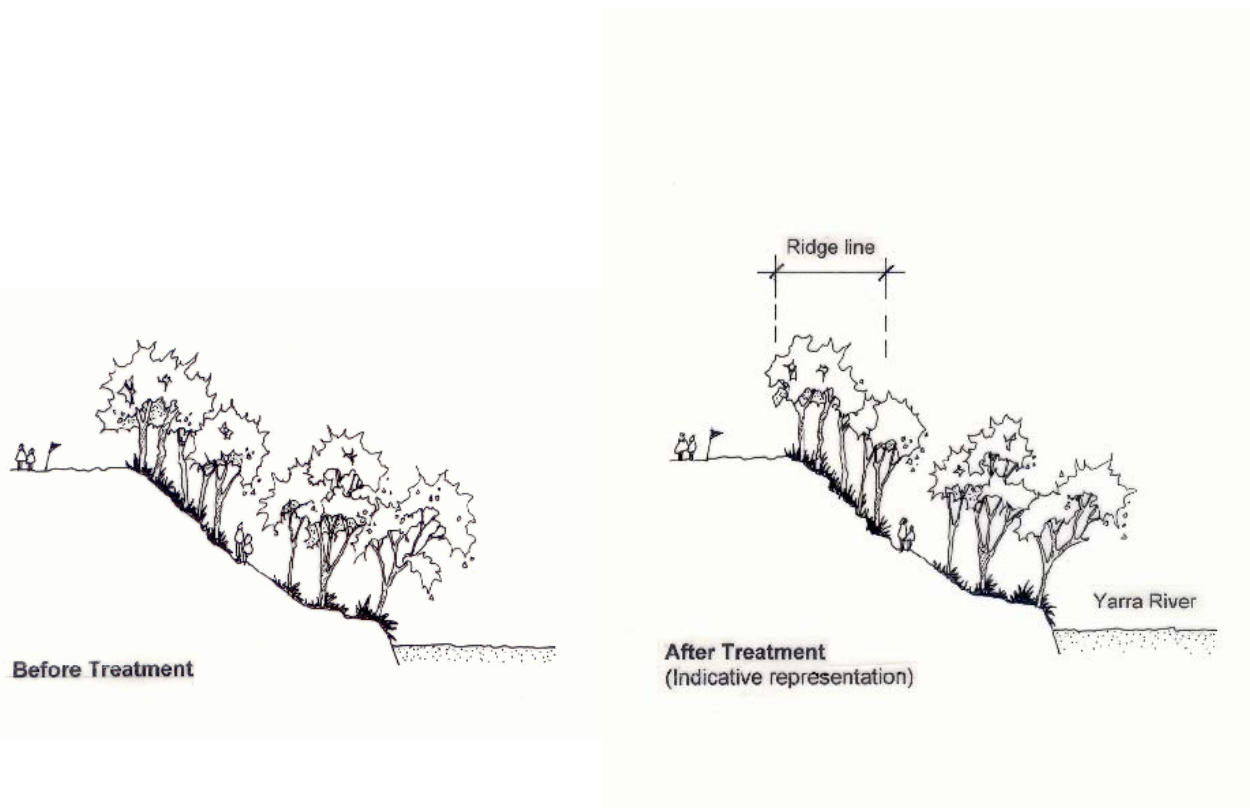


Figure 6: Tree pruning treatments

Actions

- Monitor the extent and location of the colony.
- Consider pruning only when a problem arises.
- Identify potential roost trees for pruning.
- Contract an arborist to conduct the tree pruning.
- Conduct light pruning.
- Monitor the response of the colony.
- Where further pruning is required beyond the initial light prune, seek approval of the Yarra Bend Park Trust to continue with program until the colony is prevented from expanding southwards.

Other possible measures to minimise any impacts to nearby residents

In addition to controlling the location of the colony within the defined management area, other measures to minimise any inconvenience caused by limited numbers of flying-foxes sporadically roosting on their properties could include:

- Providing residents with a legal authority to disperse any daytime roosting or night-time concentrations of animals, using noise. During the period when the colony originally established at Yarra Bend Park, three residential properties on the Yarra River's edge adjacent to the boundary of Yarra Bend Park were affected for short periods by concentrations of flying-foxes. To provide immediate relief where concentrations are creating significant disturbance at night, residents of these three properties may be provided with legal authorisation to disperse flying-foxes on their properties only and using approved noise methods and after instruction from DSE staff. This will not cause lasting effects to the flying-foxes and will be as sympathetic as possible to nearby neighbours. Surrounding neighbours will be informed of the possible use of noise where such events are authorised.

It is an offence under the *Wildlife Act 1975* for unauthorised persons to wilfully disturb wildlife. Therefore, any authorisation for approved residents to disturb flying-foxes for the purposes of preventing the concentration of flying-foxes on their properties will be closely monitored and strictly enforced. Experience shows that dispersed animals quickly rejoin the main colony and do not move in to other backyards. This low level, site-specific disturbance does not present a risk to animal welfare. Where concentrations of animals persist, DSE will take responsibility for management actions to address the problem.

Although some problems were experienced with concentrations of flying-foxes gathering in these river-front properties during the first summer (2004) after their arrival in Yarra Bend Park, no such problems were encountered in the second summer (2005) and are considered less likely now that the colony is well established in the preferred area.

- Modifying habitat on the vacant block at the end of Molesworth Street to reduce roosting opportunities and make that stretch of the Yarra River less attractive (subject to the owner's approval). Currently, this block is heavily infested with weeds and has an open drain running through it, which creates a moist and attractive area for flying-foxes to roost. By removing the weeds, revegetating with indigenous stock and possibly enclosing the drain, this area could be made less attractive for flying-foxes.
- Advising residents on ways to make their properties less attractive as roosting habitats, including minimising the use of sprinklers during hot periods and draining ponds during late summer/autumn.
- Selectively thinning the canopy of large trees to reduce roosting opportunities.

Where problems persist, DSE staff or trained and experienced contractors will prevent flying-foxes from gathering in river frontage properties.

There is much misinformation and exaggeration regarding the extent of impacts of flying-foxes in urban environments. This hinders effective management and can result in community polarisation and a failure to focus attention on real management issues, rather than perceived ones. Providing the community with accurate and reliable information on flying-foxes and their impacts and values is considered to be an important management action (section 5.4).

- ***Commercial activities***

Roosting flying-foxes could potentially have an impact on commercial operations in the Park, including the Yarra Bend Golf Course. Since arriving in Yarra Bend Park, any impact is not known. The core of the colony currently occurs around the wetland adjacent to the second hole. Attempts to move the animals away from this sensitive area could result in the colony relocating from the Park and represents a significant risk to the successful management of the colony in Melbourne.

The second green and third and sixth fairways of the golf course are close to the campsite and golfers may notice some defoliated River Red Gums and the odour and noise of the

colony, particularly during the breeding season (February-April). However, the presence of the colony does not directly interfere with golfers or obstruct them from playing their game.

An information program for staff and golfers is the most logical strategy to improve the understanding of golfers on flying-fox management. This will include interpretive signage carrying information about flying-fox ecology and golfers' regulatory requirements not to disturb or harass the animals. Leaflets and face to face advice to golfers when they are paying green fees and using the pro shop may also assist.

There may be opportunities to promote this unique feature of the course to increase patronage and create a higher profile. Several Victorian golf courses already capitalise on the presence of wildlife, including Anglesea, Growling Frog and Rosanna. In fact, the Growling Frog Golf Course in Whittlesea recently won an international award for its conservation efforts to protect the threatened Growling Grass Frog. There are parallels and similar opportunities at Yarra Bend Golf Course. This could be a particularly attractive feature to tourists, considering the close proximity of the course to the CBD and the threatened status of the Grey-headed Flying-fox.

Apart from the golf course, the only other commercial interest in the Park in the vicinity of the campsite is the Studley Park Boathouse which provides restaurant/kiosk and boat hire services. The Boathouse has experienced no impacts to date and no future impacts are expected. Again, there may in fact be opportunities to promote flying-fox viewing as one of the attractions available to Boathouse users. There may also be opportunities to offer services during the dusk fly-out, as flying-foxes leave the camp to feed at night.

- **Park visitors**

Casual park visitors may notice noise, some odour at particular time of the year and defoliated trees, but these are highly unlikely to reduce visits to the Park as a whole. Again, the presence of the colony is likely to attract more visitors than at present by adding another point of interest in the Park. This may require visitor management strategies to control any impacts on park values and on the flying-fox colony.

- **Health issues**

The establishment of a flying-fox roosting site does not pose any significantly increased risk to public health. Grey-headed Flying-foxes roosted in the Royal Botanic Gardens for almost twenty years and there were no recorded incidents of flying-fox-related illness to either Gardens employees or any of the two million annual visitors.

Less than one percent of flying-foxes are known to carry Australian Bat Lyssavirus (ABL) (CHCC 2004) and evidence shows that this virus can only be transmitted to humans in saliva from an infected flying-fox via a penetrating bite or scratch. The Commonwealth Scientific and Industrial Research Organisation (CSIRO) advises at its website that "Australian health authorities believe that the Australian Bat Lyssavirus poses a low public health risk". Exposure to faeces and urine does not constitute a risk of exposure to ABL (Queensland Health 2001), however, as with any animal, contact should be avoided. If people do not handle bats, there is no known risk of infection. In the event that someone is scratched or bitten, they should wash the area for at least five minutes with soap under running water and seek medical attention for the appropriate treatment.

Signs in the management area and extension material will be used to inform people of ways to minimise any exposure to ABL and what to do in the event of being scratched or bitten. DSE currently provides detailed information on its website and in publications. Information can also be found at other State health agency websites and the Commonwealth Government Department of Health and Ageing.

An issue that has been raised regarding flying-fox campsites is their perceived impact on water quality. Experience suggests that this issue is overstated and has little basis.

It is common for flying-foxes to roost adjacent to rivers, creeks and wetlands and there is little evidence to suggest that colonies have any significant impact on water quality. The vast majority of the total Grey-headed Flying-fox population occurs in Queensland and New South Wales, where there is virtually no evidence to suggest that they have any impact on water quality. As an example, recent testing of Coffs Creek in New South Wales by Coffs Harbour

City Council, showed that the presence of a flying-fox camp on a watercourse had no impact on water quality (CHCC 2004). Samples were taken from above and below the colony and measured a broad range of water quality parameters, including *E. coli*. The tests showed that there was no difference in water quality above or below the colony, including levels of nitrates and phosphates. Also, during the twenty years of roosting in the Royal Botanic Gardens, there was no evidence that the colony had any impact on the waterways at the Gardens.

Management actions

- 10. Continue to monitor the size and location of the colony within the management area and take specified management actions to minimise any negative impacts on nearby private properties, including:**
 - Providing residents with an authority to disperse roosting animals using noise**
 - Modifying habitat on the vacant block at the end of Molesworth Street (subject to the owner's approval)**
 - Providing advice to residents on ways to make properties less attractive as roosting habitats, including minimising the use of sprinklers during hot periods, draining water bodies (eg. ponds) during late summer/autumn, selectively thinning the canopy of large trees to reduce roosting opportunities.****DSE will ensure that no concentrations of animals remain on private properties for protracted periods.**
- 11. Undertake supervised pruning of a small section of trees from a point near the Bellbird Picnic Area toilet block to prevent the southward expansion of the colony. Pruning is to be undertaken progressively to minimise canopy removal while providing an effective boundary to the colony (see section 4.3).**
- 12. Establish a reference group and continue to liaise closely with councils and other key stakeholders on flying-fox management.**
- 13. Work cooperatively with the Yarra Bend Park Trust to inform golfers about the significance and value of flying-foxes and the need to protect them. Signage will be installed to educate golfers about flying-foxes and to inform them of their legal requirements not to disturb the animals.**
- 14. Continue to provide readily accessible information on flying-foxes, including health issues. Include signs, publications, the DSE website and letter drops for local residents.**

4.4 Goal 4: Provide improved visitor facilities at and near the campsite

The Park Strategy Plan (PV 1999, p 25) sees the role of the Bellbird Picnic Area as providing low-intensity picnic facilities, a major recreation contact point with the Yarra River and a riparian flora and fauna corridor.

The Strategy Plan (p 1, 2) notes that the Park attracts a high proportion of people in the 20-29 and over-60 age groups and a relatively low number of families. Many visitors have a high level of education, are focussed on fitness and enjoy walking and interacting with the River.

The flying-fox campsite adds a new point of interest for visitors and the improved facilities and habitat resulting from this Management Plan will enhance visitor experience.

Vehicle access and facilities

The campsite in the Park is adjacent to the Bellbird Picnic Area (figure 3 and photo, opposite) which has vehicle access directly off Yarra Boulevard and high quality facilities, including a sealed carpark, toilets, barbecues, seats and picnic tables, and a small jetty beside the River. These facilities are expected to be adequate in future and no expansion is proposed. The Park Strategy Plan (PV 1999, p 25) recommends investigating re-configuring the road entrance and exits to the Bellbird Picnic Area to improve safety.



Visitor use needs to be monitored and action taken if necessary to maintain the area's character. If increasing numbers of visitors use the area at dusk to watch the flyout, lighting should be considered at the carpark and viewing platform, and along the short connecting path.

There are good opportunities to provide for water-based viewing of the colony, but canoeing needs to be monitored to ensure that there are no significant impacts on the colony. Educating the public on responsible viewing should reduce disturbance. Signage could be erected at the jetty.

To the east, an elevated area of parkland near the corner of Wills St and Redmond St provides panoramic views to the city with excellent views of the flying-foxes flying out along the river valley at dusk. Seats are provided, but there are no other facilities apart from walking paths. Vehicle access to the site is via suburban streets and high levels of use are not appropriate.

Several points along Yarra Boulevard also provide a good view of flying-foxes flying out at dusk. An existing parking lane appears to provide adequately for people wanting to pull over and catch this view. Similarly impressive to the dusk fly-out is the return to camp at dawn, as thousands of flying-foxes return from all directions after feeding throughout the suburbs of Melbourne at night. The best views of this are at the camp itself, as flying-foxes glide overhead to return to their daytime roost.

Monitoring the levels of use of the Bellbird Picnic Area will be important to help the site manager adjust to changing circumstances.

Signs

There are currently no orientation or interpretive signs related to the flying-fox colony. Signs are needed to assist visitors and provide advice regarding appropriate visitor behaviour, and information on flying-fox biology and ecology (figure 5 and section 4.5). Information on the signage will also be used to interpret other aspects of the ecology of the Park, including around the artificial wetland.

Signage will be of simple construction and consistent with existing signage throughout Yarra Bend Park, with angled screen printed metal signs fixed to a galvanised post at approximately one metre high and set into the ground (see appendix 3).

Signs will be placed at the viewing platform, jetty and along the walking track on the flats area. Direction signs to the campsite could also be provided at key visitor sites, eg the boathouses, and signs installed on the golf course to inform golfers about the colony and their legal responsibilities not to disturb the flying-foxes.

Access tracks and lookout area

Walking and cycling tracks in the area were reviewed in the Trails Strategy (PV 2001, p14, 19). Recommendations included:

- *Construction of a gravel path beside the entry road from Yarra Boulevard to the Bellbird Picnic Area, to provide a pedestrian link between the picnic area and the Wills St/Willsmere area to the east (above Yarra Boulevard).*

This new path would be useful for visitors interesting in viewing flying-foxes from the picnic area, and the Wills St/Willsmere area. It would also provide future residents of the Willsmere area with good walking access to the picnic and roosting area.

- *Upgrading the dirt trail along the east side of the River (next to the campsite) for walkers only.*

The trail is currently poorly drained and severely eroded along a steep section linking the picnic area to the river flats (top photo, right).



The lookout area to the north of Bellbird Picnic Area is also degraded with damage to soils and vegetation (bottom photo, right). This needs to be constructed to carry potentially increased numbers of visitors – it provides the best view of the colony. An informal track from the lookout area up the hill to Yarra Boulevard is also in poor condition.



Under this Plan, these tracks will be constructed, rationalised or resurfaced to provide significant conservation and visitor benefits.

The track on the river flat to the north of the picnic area (figure 5) will be realigned to allow for the wetland and substantial revegetation beside the River. The realigned track will help keep Park users away from the core of the colony and reduce disturbance impacts.

Although not detailed in the Trails Strategy, there is potential to create a formal path to replace the current informal worn dirt track from the viewing platform north east to the Yarra Boulevard. Future discussions with the Yarra Bend Park Trust will determine the appropriateness of this pathway.

All pathways will be constructed consistent with Parks Victoria standards, between 1.2 – 1.8 metres wide with a Lilydale Topping surface (see appendix 4 for detail). Steps will be introduced on steeper gradients where required (see appendices 5 and 6 for detail). Small timber 'step-overs' or 'bridges' may be required where pathways cross drainage lines (see appendix 7 for detail). This will be determined in the final design stages.

Management actions

- 15. Install signs in the Bellbird Picnic Area to orient and inform visitors and encourage appropriate behaviour near the flying-fox colony (figure 5).***
- 16. In conjunction with the site managers, install direction signs to the campsite at the boathouses, and information/interpretation signs at the golf course.***
- 17. Construct a gravel walking path beside the entry road to the Bellbird Picnic Area.***
- 18. Realign and upgrade walking tracks from the Bellbird Picnic Area to the lookout point, north to Yarra Boulevard (subject to discussions with the Yarra Bend Park Trust) and along the river flats around the colony. Use signs as necessary to regulate access to the main roost area near the wetland (figure 5).***
- 19. Monitor levels of recreational use of the river and Bellbird and Wills St park areas and take appropriate action in response to any impacts.***

4.5 Goal 5: Increase community understanding and support for flying-fox conservation

There are few natural areas remaining near Melbourne where large numbers of threatened wildlife are as highly visible as at the flying-fox campsite in Yarra Bend Park. This provides the potential to attract visitors, interpret some important environmental issues and promote the importance of Yarra Bend Park as a refuge for flora and fauna in a highly urbanised environment. Australian mammals are rarely seen during daylight hours and the flying-fox colony provides the opportunity to view a threatened endemic mammal during the day and at dusk as they fly out to feed.

DSE has provided up-to-date information on flying-foxes through media releases, publications and their website, however, many people still have a poor understanding of flying-fox conservation issues, including the causes of their threatened status and the conflicts that arise in urban centres (Ford 2002; Lunney *et al.* 2002). This hinders effective management and results in a failure to focus attention and resources on important management issues.

There is an ongoing need to provide reliable and accurate information, interpretation and education on these issues so that informed and realistic community debate can occur regarding urban flying-fox management and recovery efforts for this threatened species. It is important that the community becomes more understanding and accepting of living with wildlife, as natural environments continue to be degraded and urban areas become more important as refuges for wildlife, particularly more adaptable species such as the Grey-headed Flying-fox.

Information

There are limits to the effectiveness of the general media in creating community understanding about complex environmental issues. Generally, people pay little attention to issues that do not affect them directly. Nevertheless, it is important to continue to provide accurate information about the status of flying-foxes and the basis for management actions taken at Yarra Bend Park. The community reference group could assist in this task.

Useful methods of disseminating information include media releases and briefings for metropolitan and local papers, radio and television, use of DSE's Customer Service Centre and website, publications, mail outs and direct discussions with key stakeholders. Emphasis should be placed on providing information for people most likely to be affected by the colony in the Park, ie nearby residents, local councillors, visitors and commercial operators.

Interpretation

The campsite is highly visible to visitors, providing excellent opportunities to interpret animal behaviour and associated management and conservation issues. Interpretation has the potential to engage visitors in learning about flying-foxes, increasing appreciation and building support for sound management practices. The basic aim at the campsite is to develop an understanding of flying-fox issues, value their presence and gain support for retention of the colony in the Park. It is also to highlight the importance of Yarra Bend Park and the role that this significant remnant plays as an urban repository for indigenous flora and fauna.

The beneficial role of flying-foxes on forest regeneration along the east coast of Australia needs to be included in interpretation and community education programs, together with an explanation of the impact of flying-foxes on roost sites. The importance of retaining and protecting remnant areas of bush in urban areas - such as Yarra Bend Park - also needs to be stressed.

Face to face interpretation often provides the most effective way of increasing appreciation of wildlife management, but opportunities are limited by the cost and availability of staff or volunteers. If levels of interest are sufficient and resources permit, there may be opportunities for interpretive talks by Parks Victoria staff or volunteers at the campsite, at some time into the future.

Interpretive signs are frequently used to tell interesting stories about natural and cultural features and would be a positive way of introducing casual visitors to flying-fox issues. A viewing platform will be constructed on the edge of the Yarra River, north of the picnic area car park. A pathway from the car park to the viewing platform will also be constructed. This

is an obvious site for signs and there are also opportunities to tell supporting stories along the walking track near the campsite. A set of robust binoculars may also be installed on the viewing platform, linked to interpretive information on flying-fox ecology and management and park natural values. The location of interpretive signs is shown on figure 5. Construction detail for the viewing platform is included at appendix 8.

Simple self-guiding walk leaflets are inexpensive and easy to update and could be made available on the DSE website and at the Yarra Bend Park Parks Victoria office.

Interpretive themes need to be developed and a series of related stories developed to engage visitors. Signs and leaflets are now commonplace and innovative design is also important to encourage visitors to pause and read. This could include use of art works to add interest and generate visitor response. Proposed topics for signs include the following.

Location	Subject
Approach to lookout	Presence of flying-foxes to Victoria and Melbourne
At lookout	Flying-fox habitat needs, important ecological role, social behaviour, campsite use, safety issues
On river flat path	Impacts of flying-foxes and appropriate management responses, roost structures, wetlands and park values, other wildlife, the importance of Yarra Bend Park as a wildlife corridor
Golf course	About flying-foxes, appropriate behaviour and legal responsibilities
Jetty	Enjoying the colony from the River and responsible behaviour

Education

There is a high level of interest in the campsite from educational institutions. The colony provides the opportunity to consider wildlife management issues, including threatened species conservation and the management of wildlife species in urban environments. The site could be increasingly used as a key component of visits to the Park by school and tertiary students.

Promotion

Few tourists currently visit the Park (most visitors are from Melbourne) and promotion would be needed to inform and attract additional tourists to the campsite. Low-key promotion in conjunction with ongoing Yarra Bend Park Trust and Parks Victoria's promotion of Yarra Bend Park, and with other wildlife and natural attractions, would probably be the most effective way to attract modest numbers of additional tourists.

Media coverage and information on internet sites and in publications is likely to be the most effective way of attracting more Melbourne visitors. Word of mouth recommendation is also important, so high quality facilities and presentation at Bellbird Picnic Area will be important.

The improved facilities and interpretation at the Bellbird Picnic Area will cater for any initial increase in site visits and provide opportunities to promote the strong conservation messages associated with threatened wildlife and associated habitat protection. The site could become a favoured destination for walkers if promoted appropriately.

The level of promotion will be determined by the Yarra Bend Park Trust.

Management actions

- 20. Provide ongoing information on flying-fox management and the Yarra Bend Park campsite in media releases, publications, information services, the Internet and at the local level.**
- 21. Install a viewing platform, robust binoculars and interpretive signage, and consider opportunities to provide face to face interpretation near the campsite.**
- 22. Integrate the campsite into educational visits to the Park and encourage use related to wildlife management.**
- 23. Integrate the campsite into promotional material for the Park and other natural and wildlife attractions near Melbourne and consider further opportunities to encourage visits to the Park.**
- 24. Engage the reference group in discussions regarding flying-fox management across Greater Melbourne.**

5 Implementing the Plan

Major actions (listed in section 4), priorities, responsibilities and key stakeholders are set out in the following program. Successful implementation of this Plan will require close cooperation between the responsible organisations.

Funding to implement the program is to be provided largely by DSE (section 4.1).

The overall timeline and priority implementation program of the Plan are as follows.

Timeline

2004/05	2005/06	2006/07	2007/08	2008/09	Post 2009/10
Development of Management Plan. DSE Project Manager responsible for delivery.	Implementation of Management Plan. DSE Project Manager responsible for delivery.	Implementation of Management Plan. PV deliver Management Plan, overseen by DSE Port Phillip Region.	Implementation of Management Plan. PV deliver Management Plan, overseen by DSE Port Phillip Region	Complete delivery of Management Plan. PV deliver Management Plan, overseen by DSE Port Phillip Region.	PV assume responsibility for maintenance of campsite at Yarra Bend Park. DSE maintain ongoing responsibility for flying-fox management and policy.

Priority action program

Action	Priority	Prime responsibility	Key stakeholders
Goal1: Successfully develop a sustainable flying-fox campsite in Yarra Bend Park			
1. Formalise the responsibilities of DSE, the Yarra Bend Park Trust and Parks Victoria for implementation, ongoing management and funding responsibilities for the management area.	Very high ●●●●	DSE	Yarra Bend Park Trust, Parks Victoria
2. Conduct an extensive revegetation/regeneration and weed control program throughout the management area and construct a wetland and artificial roost structures at sites shown on the masterplan (figure 5), in accordance with approved engineering specifications. Ensure minimal impacts on roosting flying-foxes during construction and maintenance. Employ an expert observer during excavations to identify any sites or artefacts of cultural significance.	Very high ●●●●	DSE	Yarra Bend Park Trust, Parks Victoria
3. Undertake ongoing monitoring of the flying-fox colony and campsite and adapt management practices in response to changing circumstances. Include fortnightly population counts and mapping, annual assessments of the success of habitat improvements and the impact of the colony.	Ongoing	DSE	Yarra Bend Park Trust, Parks Victoria, local community
4. Ensure that the colony remains in the identified management area. If other colonies form in the Park or elsewhere in Melbourne, consider the merits of these sites in consultation with the land manager. Undertake appropriate management actions to provide for sustainable roosting at the site, or undertake dispersal of the colony where appropriate and practicable.	Very high ●●●●	DSE	Yarra Bend Park Trust, Parks Victoria, local community, land managers
5. At the end of the five-year management plan, a strategy will be prepared for the continued management of the flying-fox colony in Yarra Bend Park.	Very high ●●●●	DSE	Yarra Bend Park Trust, Parks Victoria, local community, land managers

Goal 2: Enhance vegetation and other environmental values in and near the campsite			
6. <i>Implement the program of works identified in the regeneration/revegetation plan, including extensive weed control and indigenous planting as specified in the planting schedules (appendix 2). Construct wetlands to provide increased habitat diversity and treat road runoff.</i>	Very high ●●●●	DSE	Yarra Bend Park Trust, Parks Victoria
7. <i>Monitor Red Fox numbers and increase control measures if numbers increase in the management area.</i>	Medium ●●	DSE/Parks Victoria	Yarra Bend Park Trust, Parks Victoria
8. <i>Involve the community in clearly identified components of the revegetation work to increase involvement and ownership of the project.</i>	Medium ●●	DSE/Parks Victoria	Yarra Bend Park Trust, Parks Victoria, local community
9. <i>Monitor and assess progress and adapt management to ensure successful weed control and regeneration and revegetation.</i>	Ongoing	DSE	Yarra Bend Park Trust, Parks Victoria
Goal 3: Minimise any negative impacts of flying-foxes on residents and park users			
10. <i>Continue to monitor the size and location of the colony within the management area and take specified management actions to minimise any negative impacts on nearby private properties, including: - Providing residents with an authority to disperse roosting animals using noise – Modifying habitat on the vacant block at the end of Molesworth Street (subject to the owner’s approval) – Providing advice to residents on ways to make properties less attractive as roosting habitats, including minimising the use of sprinklers during hot periods, draining water bodies (eg. ponds) during late summer/autumn, selectively thinning the canopy of large trees to reduce roosting opportunities. DSE will ensure that no concentrations of animals remain on private properties for protracted periods.</i>	Ongoing	DSE, immediate residents	Yarra Bend Park Trust, Parks Victoria, local community
11. <i>Undertake supervised pruning of a section of trees from a point near the Bellbird Picnic Area toilet block to prevent the southward expansion of the colony. Pruning is to be undertaken progressively to minimise canopy removal while providing an effective boundary to the colony (see section 4.3 and figure 6).</i>	Very high ●●●●	DSE	Yarra Bend Park Trust, Parks Victoria, local community
12. <i>Establish a reference group and continue to liaise closely with councils and other key stakeholders on flying-fox management.</i>	Very high ●●●●	DSE	DSE, Yarra Bend Park Trust, Parks Victoria, local Councils, RBG, Victorian Field Naturalists, RSPCA, Eastern Metropolitan Fruit Growers’ Association
13. <i>Work cooperatively with the Yarra Bend Park Trust to inform golfers about the significance and value of flying-foxes and the need to protect them.</i>	High ●●●	DSE	Yarra Bend Park Trust, Parks Victoria, golf course
14. <i>Continue to provide readily accessible information on flying-foxes, including health issues. Include signs, publications, the DSE website and letter drops for local residents.</i>	Ongoing	DSE	Local and general community

Goal 4: Provide improved visitor facilities at and near the campsite			
15. <i>Install orientation and interpretation signs in the Bellbird Picnic Area to orient visitors and encourage appropriate behaviour near the flying-fox colony (figure 5).</i>	Very high ●●●●	DSE	Yarra Bend Park Trust, Parks Victoria, park users
16. <i>In conjunction with the site managers, install direction signs to the campsite at the boathouses, and information/interpretation signs at the golf course.</i>	High ●●●	DSE	Yarra Bend Park Trust, Parks Victoria, park users, golf course, boathouses
17. <i>Construct a gravel walking path beside the entry road to the Bellbird Picnic Area.</i>	Medium ●●	DSE	Yarra Bend Park Trust, Parks Victoria
18. <i>Realign and upgrade walking tracks from the Bellbird Picnic Area to the lookout point, north to Yarra Boulevard (subject to discussions with the Yarra Bend Park Trust) and along the river flats around the colony. Use signs and fencing as necessary to regulate access to the main roost area near the wetland (figure 5).</i>	Very high ●●●●	DSE	Yarra Bend Park Trust, Parks Victoria, park users
19. <i>Monitor levels of recreational use of the river and Bellbird and Wills St park areas and take appropriate action in response to any impacts.</i>	Ongoing	Parks Victoria, DSE	Yarra Bend Park Trust, Parks Victoria, local residents, park users
Goal 5: Increase community understanding and support for flying-fox conservation			
20. <i>Provide ongoing information on flying-fox management and the Yarra Bend Park campsite in media releases, publications, information services, the Internet and at the local level.</i>	Very high ●●●●	DSE	Yarra Bend Park Trust, Parks Victoria, Councils, local and general community
21. <i>Install a viewing platform, robust binoculars and 5 or 6 thematic interpretive signs, and consider opportunities to provide face to face interpretation near the campsite.</i>	Very high ●●●●	DSE	Yarra Bend Park Trust, Parks Victoria, park users
22. <i>Integrate the campsite into educational visits to the Park and encourage use related to wildlife management.</i>	Medium ●●	Parks Victoria	DSE, Yarra Bend Park Trust, educational users
23. <i>Integrate the campsite into promotional material for the Park and other natural and wildlife attractions near Melbourne and consider further opportunities to encourage visits to the Park.</i>	High ●●●	Yarra Bend Park Trust, Parks Victoria	Yarra Bend Park Trust, Parks Victoria, general community
24. <i>Engage the reference group in discussions regarding flying-fox management across Greater Melbourne.</i>	Medium ●●	Reference Group	Yarra Bend Park Trust, Parks Victoria, Councils, local and general community

Conclusion

Managing flying-foxes in Melbourne is a major environmental and social challenge.

This Management Plan draws on the best available information to develop clear actions to consolidate the flying-fox colony at Yarra Bend Park, minimise any impacts on nearby residents and operations in the Park, and enhance community appreciation and understanding of the most significant wildlife species in the Park.

If successful, the Plan – and all the dedicated work of agency staff and community members over the last few years – will have provided a valuable contribution to effective management of a threatened wildlife species in an urban environment.

6 References

- Beardsell, C. (2003) *The Vegetation of Yarra Bend Park: A Report on the Vegetation Communities and Sub-communities of Yarra Bend Park*, Parks Victoria.
- Coffs Harbour City Council (2004) *Draft Site Management Plan for the Coffs Creek Flying-fox Camp*. Coffs Harbour City Council.
- Department of Environment and Heritage (2003) *EPBC Act. Administrative Guidelines on Significance – Supplement for the Grey-headed Flying-fox 2003 – 2004*. Department of Environment and Heritage, Canberra.
- Department of Natural Resources and Environment (2001a) *Options for the establishment of an alternative campsite for the Grey-headed Flying-fox in Melbourne*. Grey-headed Flying-fox Alternative Campsite Task Force, Department of Natural Resources and Environment, Melbourne.
- Department of Natural Resources and Environment (2001b) *Proposal for the Establishment of a Grey-headed Flying-fox Campsite at Horseshoe Bend – Report to Banyule Council*. Available at: dse.vic.gov.au
- Department of Natural Resources and Environment (2002) *Horseshoe Bend Management Plan. Development of an Alternative Roost Site for the Grey-headed Flying-fox at Ivanhoe, Victoria*. Department of Natural Resources and Environment, Melbourne.
- Eby, P. (1995) *Biology and Management of Pteropus in New South Wales. Species Report*. NSW National Parks and Wildlife Service, Hurstville, NSW.
- Eby, P. (1996) *Interactions between Grey-headed Flying-foxes Pteropus poliocephalus (Chiroptera: Pteropodidae) and its diet plants – seasonal movements and seed dispersal*. PhD Thesis, University of New England, Armidale, NSW.
- Eby, P. and Lunney, D. (2002) Managing the Grey-headed Flying-fox *Pteropus poliocephalus* as a threatened species: a context for debate. In *Managing the Grey-headed Flying-fox as a Threatened Species in NSW*. Ed. Peggy Eby and Daniel Lunney. Royal Zoological Society of New South Wales. Southwood Press, Murrumbidgee, NSW.
- Ford, D. (2002) An historical perspective of changing community attitudes towards Flying-foxes in Sydney. In: *Managing the Grey-headed Flying-fox as a Threatened Species in NSW*. Ed. Peggy Eby and Daniel Lunney. Royal Zoological Society of New South Wales. Southwood Press, Murrumbidgee, NSW.
- Grzelewski, D. (2001) Flying-foxes: Foresters on the Wing. *Australian Geographic*, April - Jun **62**.
- Hall, L. S. (2002) Management of flying-fox camps: what have we learnt in the last twenty-five years? In: *Managing the Grey-headed Flying-fox as a Threatened Species in NSW*. Ed. Peggy Eby and Daniel Lunney. Royal Zoological Society of New South Wales. Southwood Press, Murrumbidgee, NSW.
- Hall, L. S and Richards, G. (2000) *Flying-foxes: Fruit and Blossom Bats of Australia*. University of New South Wales Press, Sydney.
- Keeley, B. and Tuttle, M. (2000) *The Texas Bats and Bridges Project*. Bat Conservation International. Available at: <http://www.batcon.org/bridge/bababs.html>
- Ku-ring-gai Bat Conservation Society. FAQ about bats. Available at: www.sydneybats.org.au
- Ku-ring-gai Municipal Council (1999) *Ku-ring-gai Flying-fox Reserve Management Plan*. Ku-ring-gai Municipal Council.
- Lunney, D., Reid, A. and Matthews, A. (2002) Community perceptions of flying-foxes in New South Wales. In: *Managing the Grey-headed Flying-fox as a Threatened Species in NSW*. Ed. Peggy Eby and Daniel Lunney. Royal Zoological Society of New South Wales. Southwood Press, Murrumbidgee, NSW.
- Menkhorst, P. (1995) *Mammals of Victoria. Distribution, ecology and Conservation*. Oxford University Press, Melbourne.

- Menkhorst, P. W. and Dixon, J. M. (1985) Influxes of the Grey-headed Flying-fox *Pteropus poliocephalus* (Chiroptera, Pteropodidae) to Victoria in 1981 and 1982. *Australian Mammology* **8**: 117 – 121.
- Pallin, N. (2000) Ku-ring-gai Flying-fox Reserve: Habitat restoration project, 15 years on. In: *Ecological Management and Restoration* **1** (1).
- Parris, K. and Hazell, D. L. (2005) Biotic effects of climate change in urban environments: The case of the grey-headed flying-fox (*Pteropus poliocephalus*) in Melbourne, Australia. *Biological Conservation* **124**: 267 – 276.
- Parry-Jones, K. A. and Augee, M. (1991) Food selection by Grey-headed flying-foxes (*Pteropus poliocephalus*) occupying a summer colony site near Gosford, NSW. *Wildlife Research* **18**: 111 – 124.
- Parry-Jones, K. A. and Augee, M. (2001) Factors affecting the occupation of a colony site in Sydney, New South Wales by the Grey-headed Flying-fox, *Pteropus poliocephalus* (Pteropodidae). *Austral Ecology* **26**: 47 – 55.
- Parks Victoria (1999) *Yarra Bend Strategy Plan*. Parks Victoria.
- Parks Victoria (2000a) *State of the Parks 2000, Vol 2 Park Profiles*, pp268-269. Parks Victoria, Melbourne.
- Parks Victoria (2000b) *Yarra Bend Park Environmental Action Plan*. Parks Victoria, Deepdene.
- Parks Victoria (2001) *Yarra Bend Park – Trails Strategy Master Plan*.
- Queensland Health (2001) *Australian Bat Lyssavirus. Public Health Fact Sheet*. Queensland Health, Queensland Government.
- Tidemann, C. R. (1999) Biology and management of the grey-headed flying-fox, *Pteropus poliocephalus*. *Acta Chiropterologica* **1** (2): 151-164.
- Tidemann, C. R. and Nelson, J. E. (2004) Long distance movements of the grey-headed flying fox (*Pteropus poliocephalus*). *J. Zool. Lond.* **263**: 141 – 146.
- Webb, N. J and Tidemann, C. R. (1996) Mobility of Australian flying-foxes, *Pteropus* spp. (Megachiroptera): evidence from genetic variation. *Proceedings of the Royal Society of London, Series B* **263**: 497 – 502.

Personal communications

Dr John Nelson, former Senior Lecturer in Wildlife Management, Monash University, 11 January 2005.

Peter Menkhorst, Senior Policy Officer, Threatened Species and Communities Section, Department of Sustainability and Environment, 14 January 2005.

Dr Rodney van der Ree, Ecologist, Australian Research Centre for Urban Ecology, Royal Botanic Gardens, Melbourne, 24 January 2005.

Other sources

Also see leaflets, fact sheets and other publications on Grey-headed Flying-fox at www.dse.vic.gov.au under Plants and Animals, then Native Plants and Animals, flying-foxes.

Appendix 2: Regeneration/revegetation plan

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Regeneration/revegetation Plan for Grey-headed Flying-fox Habitat at Yarra Bend Park, Victoria.

August 2005

Lincoln Kern, Peter Gannon & Thomasin Bales

**Prepared for inclusion in report by Robin Crocker and Associates and EDGE Environmental Design,
for the Department of Sustainability and Environment**

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Revegetation/Regeneration Plan for Grey-headed Flying-fox Habitat at Yarra Bend Park, Victoria

1.0 Introduction

The following report has been commissioned by the Department of Sustainability and Environment as supplementary information to the Flying-fox Campsite Management Plan, Yarra Bend Park (Crocker *et al* 2004). This report is to be considered as an adjunct to the plan and should be viewed in context. Each section here refers to the corresponding section within the management plan.

The primary goal of this program is to ensure the long-term viability of Melbourne's Grey-headed Flying-fox colony, and the species generally.

2.0 Management area

Within Yarra Bend Park, a 26-hectare area (see Figure 3 of the management plan) has been identified for the purpose of managing Melbourne's flying-fox colony. The principal management plan will seek to provide a secure and sustainable site for the colony while enhancing park and natural values.

The existing vegetation within the management area is highly disturbed as a result of long-term pressure from agriculture, recreation, habitat fragmentation, track and road construction and weed infestation. Upper canopy coverage is generally healthy, although patchy in places, and predominated by River Red Gum (*Eucalyptus camaldulensis*) to around 10 to 30m tall and dating back somewhere between 150 and 50 years. There is little evidence of recent (i.e. last 30 years) regeneration or establishment of the upper canopy and, although occasional seedlings were found, they are struggling to establish beneath the carpeting cover of exotic herbaceous and grassy weed species. Intermediate aged saplings are rare and isolated to a few coppices and generally inadequate to replace the mature trees. There is evidence of upper canopy die-back, attributable to the recent drought, over browsing by possums and insect attack, and more recently, due to Grey-headed Flying-fox roosting.

The middle canopy vegetation is open and sparse, as characteristic of the site's EVCs, and there is clear evidence of on-going control of thicket weed species by park management. The groundstorey vegetation of low lying, wetter areas was highly infested with grassy weeds and, generally, indigenous species are non-existent.

3.0 Enhance vegetation and other environmental values of Yarra Bend Park near the campsite

The decision to establish a flying-fox roost site at Yarra Bend Park provides the Yarra Bend Park Trust, Parks Victoria and DSE with a good opportunity to concurrently improve the natural values of Yarra Bend Park in the identified management area.

This section details a vegetation management plan that has been developed for the site, incorporating components of Parks Victoria's *Yarra Bend Park: Environmental Action Plan* (2000) and Beardsell's study, *The Vegetation of Yarra Bend Park* (2003). The site is defined as the 26-hectare area that has been selected as land suitable for extension of the current roost area, encompassing a stretch of land along both sides of the Yarra River. The site is bounded in the south by the current roost site, in the west by the Yarra Bend Park Golf Course, in the north by the Eastern Freeway, and in the east by Yarra Boulevard (see Figure 3 of the management plan).

The plan aims to improve the vegetation of the site in terms of its function as a suitable roost, while also enhancing the habitat value of the site for the park's other indigenous fauna and flora. Works for the first two years will be conducted under the direction of DSE, after which site management will pass to Parks Victoria. The many Friends groups that are associated with Yarra Bend Park and flying-fox conservation should also be encouraged to assist with revegetation and weed control programs.

3.1 Principles for designing and implementing rehabilitation works

The weed control, regeneration and revegetation works that this vegetation management plan presents have been designed to address a set of general requirements and issues determined during previous efforts to establish a viable roost site (DNRE 2002a) and detailed below:

Revegetation/Regeneration Plan for Grey-headed Flying-fox Habitat at Yarra Bend Park, Victoria

- **Creating or maintaining a cool, humid, sheltered environment with roosting structures appropriate for Grey-headed Flying-foxes**

Creating or maintaining an attractive roosting environment for the Grey-headed Flying-foxes at the Yarra Bend Park site is a key requirement of the revegetation and regeneration works and, by extension, encouraging the flying-fox's continued and sustained residence of the current roosting site is the primary objective of the overall project.

Having acknowledged as much, there remains the problem of determining what constitutes an optimum roosting environment for flying-foxes. Their preferred roosting environment seems somewhat ill defined, given that the flying-foxes display a considerable degree of flexibility when it comes to choosing roosting sites. A study of the species found that the flying-foxes will establish camps in most types of closed vegetation at heights greater than three metres (Tidemann 1999), and the Yarra Bend Park colony of flying-foxes was observed, when still located in the Royal Botanic Gardens, to readily roost in higher, drier areas of the Gardens when Fern Gully was overcrowded. Since then, the colony has shown great flexibility by camping in a number of inner-city parkland locations while being progressively moved on by the DSE relocation program (DSE 2003).

Acknowledging the adaptable nature of the Grey-headed Flying-foxes when it comes to colonising roosting sites, the flying-foxes had made Fern Gully, in the Royal Botanic Gardens, their home over the last two decades. This has led to suggestions that the flying-foxes prefer a habitat that is protected from wind, has a relatively high humidity, and has some taller trees that reach above the main canopy. The current roosting positions at Yarra Bend Park might additionally suggest that despite this, some level of wind exposure is acceptable, and that the presence of wetlands or open waterways below the canopy can help to provide adequately humid conditions in the warmer months. The current site, lying within the sheltered 'valley' and low-lying floodplain area, is also relatively protected from the hot northern winds of summer and the colder south-westerly winds of winter months.

The need for roosting opportunities at heights greater than three metres highlights that the Grey-headed Flying-foxes require good quality roosting trees, although again, apart from the height requirement, what actually constitutes an acceptable roosting tree remains unclear due to the wide variety of trees that the flying-foxes have been known to select. Factors might include good flight access and the presence of branches of appropriate size and arrangement.

Despite the range of roosting trees and habitats that are acceptable for the flying-foxes, it seems that their preference is for cool, humid, sheltered sites with roosting positions of adequate height (>3m) above ground level. The current conditions at the roost site in Yarra Bend Park, with plentiful tall eucalypts above wetlands and the Yarra River waterway and shelter from winds meets these requirements. To provide a more favourable and sustainable habitat, revegetation works should aim to provide more tall trees for roosting, more upper and middle canopy trees to reduce wind exposure and provide shade, wetlands to extend the range of humid environments, and more groundstorey to retain local moisture stores.

The works on-site will thus emphasise the rehabilitation and extension of wetland areas, the retention and revegetation/regeneration of appropriate indigenous tree and shrub cover, and the revegetation/regeneration of shade-tolerant species in the ground layer to retain a cool, dense environment. These shade-tolerant species would include indigenous ground and middle canopy species, many of which may not previously have been used in local revegetation efforts.

- **Replacing invasive weeds with indigenous species**

This is a general goal across Yarra Bend Park, as detailed in *Yarra Bend Park: Environmental Action Plan* (Parks Victoria 2000). For any weed control works to remain effective over time, weed control needs to be coordinated with revegetation and regeneration works so that invasive weeds have less opportunity to move back in to treated areas. Treated areas should then become subject to regular maintenance programs so that the invasive weeds, and thus the scope and cost of the maintenance programs themselves, are kept in check.

Effective weed control will involve programs targeted for each individual weed species. Each stage of the program will require detailed and comprehensive works at the beginning, with carefully timed and targeted programs to follow in subsequent years. This will particularly be the case for the invasive exotic herbaceous and grassy weed species found on-site [particularly Soursob (**Oxalis pes-caprae*) and Phalaris (**Phalaris aquatica*)] which must be dealt with thoroughly through a series of strategic control efforts conducted over several years.

Revegetation/Regeneration Plan for Grey-headed Flying-fox Habitat at Yarra Bend Park, Victoria

▪ Encouraging the regeneration of indigenous species

The site's riparian environment has a few indigenous species that would readily regenerate in greater numbers if smothering ground layer weeds (such as *Oxalis pes-caprae*, *Phalaris aquatica* and *Vinca major*) were removed, particularly River Red Gum (*Eucalyptus camaldulensis*), Silver Wattle (*Acacia dealbata*), Tree Violet (*Meliclytus dentatus*, formerly *Hymenanthera dentata*) and Prickly Currant Bush (*Coprosma quadrifida*). These species are resilient and, as other sites along the Yarra and Plenty Rivers demonstrate, are able to regenerate so successfully that they can become thickets that out-compete other species. Such regeneration would be encouraged by the above-mentioned weed control programs, so it is suggested that, for the most part, these species need not be planted in revegetation works programs, except in areas where they are truly absent (yet appropriate for the host EVC).

▪ Revegetation of missing indigenous species

With weed control encouraging regeneration of indigenous species already present, only those that are currently absent or are present in disproportionately small numbers would need to be introduced through revegetation programs. Given that indigenous trees and shrubs are mostly present at the rate expected within the respective EVCs, and considering the weedy, depauperate nature of the groundstorey over most of the site, groundstorey plants would make up a large proportion of revegetation plantings. On-site wetlands are also lacking indigenous plant content, and wetland plants would thus also contribute considerably to planting lists.

It should be noted that revegetation works would best introduce species appropriate to each host EVC, and should utilise indigenous species grown from local provenance propagules. There is also a need to time species reintroduction carefully – some species will most successfully establish if planted into freshly weeded sites, while other species would best be planted after sites have been stabilised and have maintained a weed-free status over several years. Such details will need to be clarified when the specific revegetation projects are designed at later dates.

▪ Retaining nutrients on site and dealing with naturally introduced species

It is likely that the flying-fox colony will contribute additional nutrients to the roost site's soil through their faeces and droppings (KMC 1999). Whilst this is a natural process there are likely to be changes to the site's vegetation cover associated with nutrient increases. We would expect, over time, a shift towards a more closed woodland association, with increased vegetative cover within the middle and upper canopies. These changes are likely to increase localised site humidity and upper canopy roost potential, thereby further improving the long-term suitability of the roost sites as Grey-headed Flying-fox habitat.

Flying-foxes also introduce seeds to roost areas from the species which they have been feeding on, via their droppings (KMC 1999), or may be carrying their pelt. Species that germinate and that are indigenous to the site's EVCs should be retained and their introduction considered a natural ecological process that contributes to a more diverse and resilient habitat for the flying-foxes. Non-indigenous species, such as any one of Melbourne's introduced fig-tree species or fruit trees, will be controlled as part of the weed control program within the management area.

▪ Ensuring stable, maintainable areas of revegetation/rehabilitation

To avoid creating large areas requiring an overwhelming amount of maintenance work at any one time, and to prevent the wholesale elimination of humid understorey environments, works should progressively be carried out in small areas to create a mosaic pattern. Careful planning of localised stages of weed control and revegetation would ideally create the mosaic in such a way that after three years, all areas would combine to form a larger, contiguous area of healthy indigenous habitat that is relatively weed-free. Any works that follow after that point would then be enhancing areas already transformed, and would benefit from not having to compete with such an overwhelming presence of invasive weeds as currently exists.

3.2 Measuring project results: habitat-hectare site assessment

A habitat-hectare assessment was conducted in order to measure any detrimental effects that the presence of Grey-headed Flying-foxes may have on the vegetation of the new roost site at Yarra Bend Park, and to measure the positive effects that the revegetation/rehabilitation programs which are tied to the presence of the Grey-headed Flying-foxes will have on the vegetation of the site.

The habitat-hectare assessment method was developed in order that statewide consistency could be achieved in the quantification of indigenous vegetation habitat quality. Habitat-hectare assessments rely on

Revegetation/Regeneration Plan for Grey-headed Flying-fox Habitat at Yarra Bend Park, Victoria

the comparison of a remnant native vegetation stand to a standard 'benchmark stand'. Benchmarks have been constructed for each Ecological Vegetation Class (EVC) within each Victorian bioregion, as typical measures of what each EVC would be like if in a mature and long-undisturbed state (Parkes *et al* 2003).

A habitat-hectare is a site-based measure of quality and quantity of native vegetation that is assessed in the context of the relevant vegetation type. This measure can be consistently applied across the State. If it is assumed that an unaltered area of natural habitat (given that it is large enough and is within a natural landscape context) is at 100% of its natural quality, then one hectare of such habitat will be equivalent to one habitat-hectare (DNRE 2002b).

A habitat-hectare assessment of the study area was conducted in order to determine the site's current habitat 'value'. This baseline assessment enables:

- Comparative, temporal assessments to gauge the extent of the longer term impacts that the Grey-headed Flying-foxes will have had at their roost sites;
- Identification of floristic and habitat site aspects that can be improved;
- Quantification of the Net Gain credits associated with the revegetation/rehabilitation works; and
- Quantification of the Net Gain credits associated with the wetland developments.

The EVC benchmarks used in this report are available from the Department of Sustainability and Environment web site:

1. Go to <http://www.dse.vic.gov.au>
2. Click on the link to Conservation and Environment
3. Click on the link to Ecological Vegetation Class (EVC) Benchmarks by Bioregion
4. Click on the links to the Victorian Volcanic Plain and the Highlands - Southern Fall bioregions for the relevant EVC benchmarks.

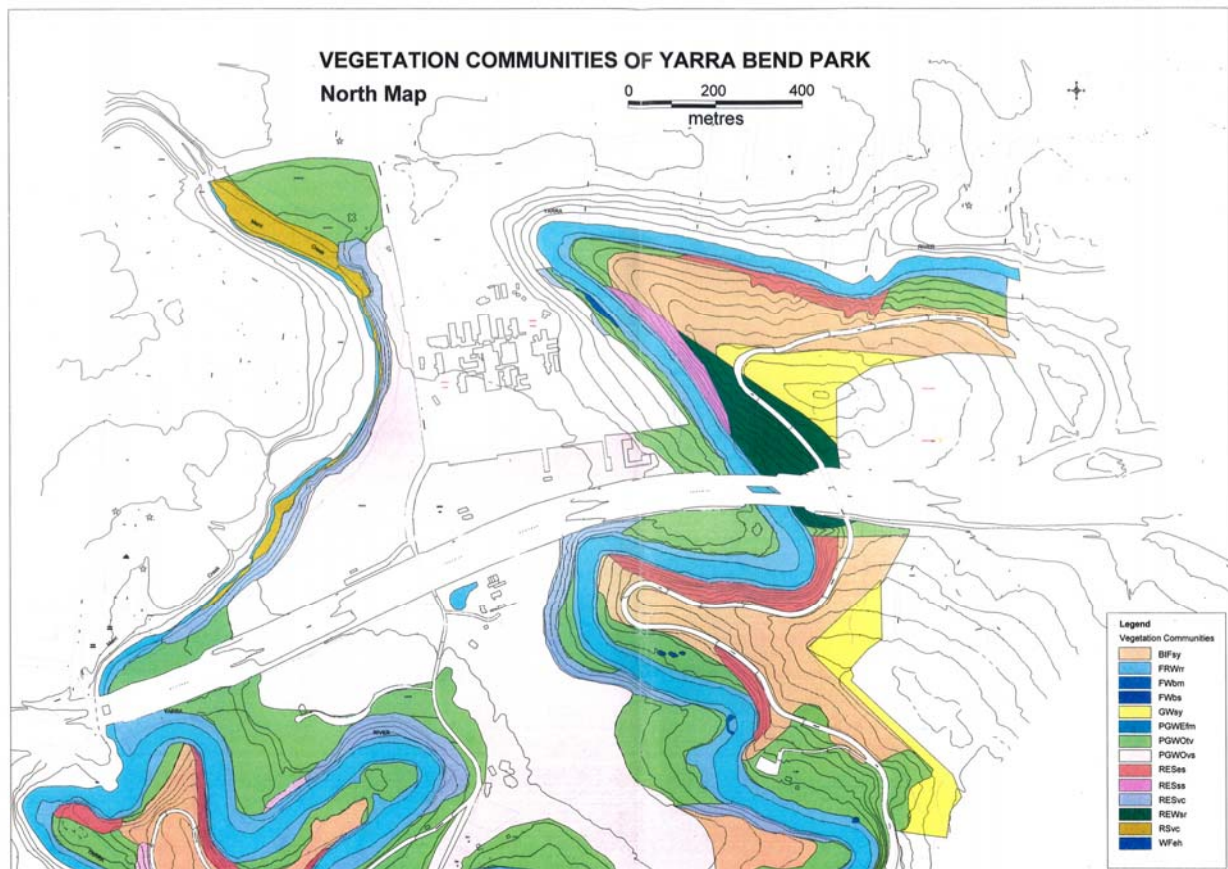
Any area within the study site with greater than 100% of the indigenous benchmark tree canopy cover or 10% of the collective indigenous understorey benchmark cover is to be assessed for its habitat-hectare value (Parkes *et al* 2003). In this instance, most of the site has greater than the required benchmark tree canopy cover, as well as at least 10% cover of indigenous groundstorey vegetation, and was therefore assessed. Areas from which most of the canopy trees have been removed have little to no indigenous groundstorey cover and have largely been infested by exotic (weed) grass species. These areas do not meet criteria for habitat-hectare assessment and have been omitted. The golf course has also been omitted on the same rationale.

Stands of vegetation within the study area which are of a different floristic sub-community or EVC, or a different level of vegetation quality, must be assessed individually. To do this the stands are identified and mapped into separate 'polygons' which are, in this instance, labelled as sites HZ1 to HZ16 (see Figure 2, 'Habitat-hectare polygons' for a map of the polygons). Each polygon can then be assessed individually, and its area (in hectares) can be accurately measured using CAD or a GIS.

The floristic communities found at the study site were mapped in 2003 by Cam Beardsell, as detailed in *The Vegetation of Yarra Bend Park* (Beardsell, 2003). Beardsell identified ten Floristic Communities (FCs), which he further subdivided into fourteen sub-communities, within Yarra Bend Park. Each of these sub-communities is described in detail in Beardsell's report (2003), and those relevant to this study are summarised in Table 1, 'Floristic Communities and EVC benchmarks of habitat zone polygons'. The extent of the relevant vegetation sub-communities are also shown in Figure 1, 'Floristic communities of the northern reach of Yarra Bend Park (Beardsell 2003)'.

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Figure 1. Floristic communities of the northern reach of Yarra Bend Park (Beardsell 2003)



In 2002, the Department of Sustainability and Environment conducted broad-scale mapping of EVCs across the Port Phillip and Westernport region (DNRE 2002c). This mapping process lacked the detail at scale and the ground-truthing of Beardsell's study. Subsequently, a comparison of the department's EVCs and Beardsell's vegetation communities was conducted to determine the EVC benchmarks relevant to this study. Table 1, 'Floristic Communities and EVC benchmarks of habitat zone polygons', outlines the relevant vegetation sub-community, bioregion, and EVC benchmark used to assess each of the habitat-hectare polygons (see Beardsell (2003) for detailed descriptions of the vegetation sub-communities and Oates and Taranto (2001) for detailed descriptions of the EVCs).

EVC benchmarks differ between bioregions, and Yarra Bend Park is located at a meeting point of bioregions. DSE maps indicate that the western part of the Park lies within the Victorian Volcanic Plain Bioregion, that the eastern part of the Park lies within the Gippsland Plain Bioregion, and that the line of contact between the two roughly follows the course of the Yarra River. Advice from DSE, however, indicates that the scale of bioregion mapping could not indicate the complexity of Yarra Bend Park, at which vegetation communities associated with surficial Silurian sedimentary rocks are considered to be outliers of the Highlands-Southern Fall Bioregion (pers. comm. James Todd, DSE). Given this, and having identified that the site contained basaltic outcrops on the western side of the River and Silurian sedimentary rock outcrops on the eastern side of the River, the Yarra River was taken as the site's dividing line between the Victorian Volcanic Plain and the Highlands-Southern Fall Bioregions.

Revegetation/Regeneration Plan for Grey-headed Flying-fox Habitat at Yarra Bend Park, Victoria

Table 1. Floristic Communities and EVC benchmarks of habitat zone polygons

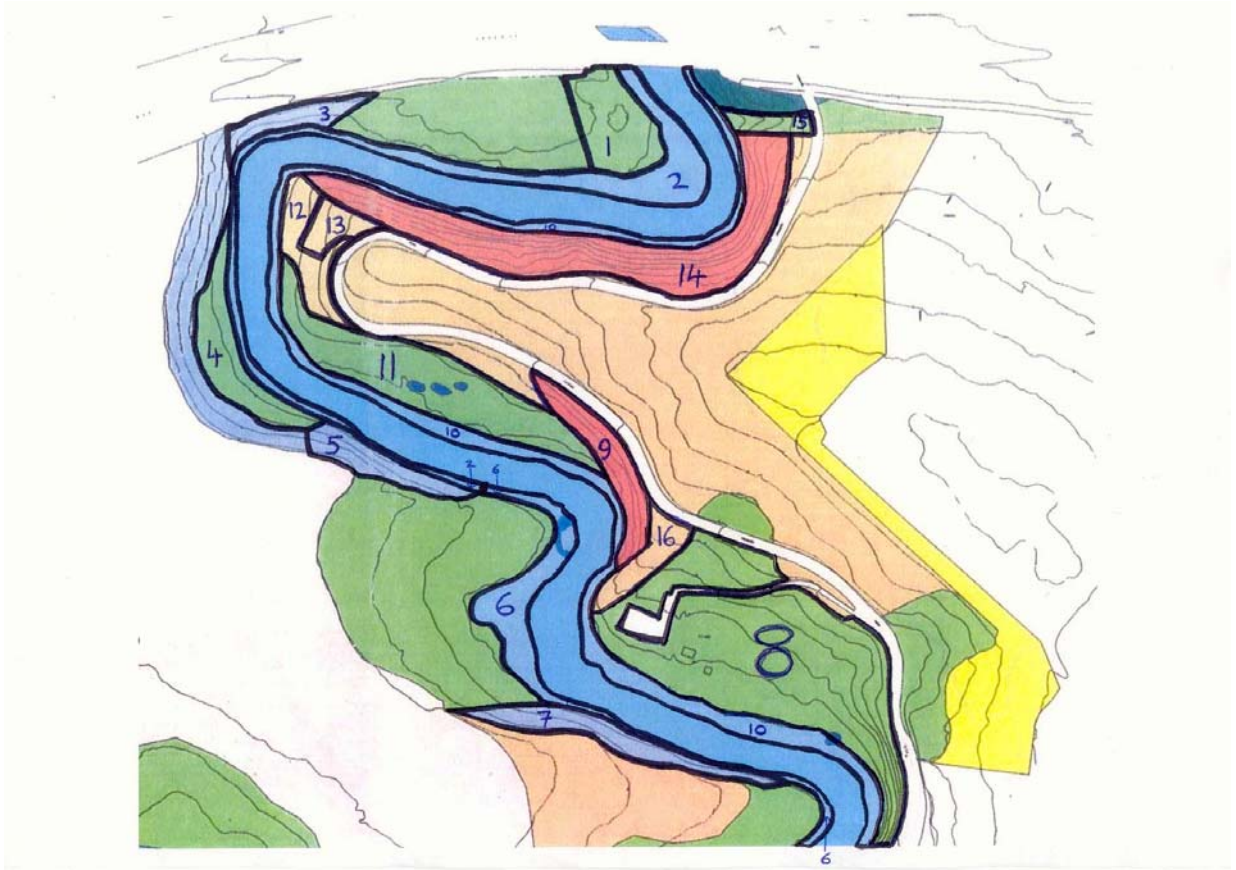
Polygon	Bioregion	Floristic Community (Beardsell 2003)	EVC benchmark (DSE 2004a-i)
HZ1	Victorian Volcanic Plain	Plains Grassy Woodland (terrace/valley) (PGWOtv)	Plains Grassy Woodland (PGW 55)
HZ2	Victorian Volcanic Plain	Floodplain Riparian Woodland (riverbank) (FRWrr)	Floodplain Riparian Woodland (FRW 56)
HZ3	Victorian Volcanic Plain	Riverine Escarpment Scrub (volcanic cliff) (RESvc)	Escarpment Shrubland (ES 895)
HZ4	Victorian Volcanic Plain	Plains Grassy Woodland (terrace/valley) (PGWOtv)	Plains Grassy Woodland (PGW 55)
HZ5	Victorian Volcanic Plain	Riverine Escarpment Scrub (volcanic cliff) (RESvc)	Escarpment Shrubland (ES 895)
HZ6	Victorian Volcanic Plain	Floodplain Riparian Woodland (riverbank) (FRWrr)	Floodplain Riparian Woodland (FRW 56)
HZ7	Victorian Volcanic Plain	Riverine Escarpment Scrub (volcanic cliff) (RESvc)	Escarpment Shrubland (ES 895)
HZ8	Highlands-Southern Fall	Plains Grassy Woodland (terrace/valley) (PGWOtv)	Plains Grassy Woodland (PGW 55)
HZ9	Highlands-Southern Fall	Riverine Escarpment Scrub (exposed sedimentary cliff) (RESes)	Escarpment Shrubland (ES 895)
HZ10	Highlands-Southern Fall	Floodplain Riparian Woodland (riverbank) (FRWrr)	Floodplain Riparian Woodland (FRW 56)
HZ11	Highlands-Southern Fall	Plains Grassy Woodland (terrace/valley) (PGWOtv)	Plains Grassy Woodland (PGW 55)
HZ12	Highlands-Southern Fall	Box-Ironbark Forest (riverspur) (BIFsy)	Box Ironbark Forest (PGW 61)
HZ13	Highlands-Southern Fall	Box-Ironbark Forest (riverspur) (BIFsy)	Box Ironbark Forest (PGW 61)
HZ14	Highlands-Southern Fall	Riverine Escarpment Scrub (exposed sedimentary cliff) (RESes)	Escarpment Shrubland (ES 895)
HZ15	Highlands-Southern Fall	Plains Grassy Woodland (terrace/valley) (PGWOtv)	Plains Grassy Woodland (PGW 55)
HZ16	Highlands-Southern Fall	Box-Ironbark Forest (riverspur) (BIFsy)	Box Ironbark Forest (PGW 61)

Figure 2, 'Habitat-hectare polygons', shows the extent of each of these polygons, and their habitat values are summarised in Table 2, 'Quantification of habitat-hectares at Yarra Bend Park'. It is important to note that these values are representative of the date of survey. Polygons HZ6 and HZ10 therefore score lower than they would have a year ago due to the presence, since October 2003, of the Grey-headed Flying-fox colony and associated defoliation and general impact to the upper canopy.

Furthermore, the habitat-hectare assessment methodology, outlined in Parkes *et al* (2003), requires that the precautionary principle be applied when assessing sites outside of the autumn/spring flowering season. In this project therefore all of the HZ polygons are presumed to contain plants of the Large Herb, Medium Herb and Small Herb life types. This effectively increases each site's understorey habitat-hectare score by 10 points (i.e. sites score 15 points of 25). The extensive cover of exotic herbaceous and grassy weed species however makes it unlikely that these life types are present, or indeed, likely to regenerate without assistance. It would be safe to presume therefore that the habitat-hectare scores of polygons HZ1-2, 4-6, 9-11 & 14-16 would be 10 points lower than that indicated in Table 2, 'Quantification of habitat-hectares at Yarra Bend Park' below.

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Figure 2. Habitat-hectare polygons



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Table 2. Quantification of habitat-hectares at Yarra Bend Park

Identifiers		Max. score	HZ1	HZ2	HZ3	HZ4	HZ5	HZ6	HZ7	HZ8
EVC benchmark			PGW (EVC55)	FRW (EVC 56)	ES (EVC 895)	PGW (EVC 55)	ES (EVC 895)	FRW (EVC 56)	ES (EVC 895)	PGW (EVC 55)
Site condition	Large old trees	10	3	10	-	9	-	6	-	4
	Canopy cover	5	3	5	4	4	5	1	4	3
	Understorey	25	15	15	5	15	15	15	15	5
	Lack of weeds	15	0	0	0	0	4	0	4	0
	Recruitment	10	6	6	0	6	6	10	10	3
	Organic litter	5	5	3	2	3	5	3	5	0
	Logs	5	0	2	0	0	0	3	5	0
L'scape	Patch size	10	8	8	8	8	8	8	8	8
	Neighborhood	10	2	2	1	2	2	2	2	1
	Distance to core	5	4	4	4	4	4	4	4	4
HABITAT SCORE %		100	46	55	(24/90) = 27*	51	(49/90) = 54*	52	(57/90) = 63	28
Area of the habitat zone (hectares)			??							
Estimated existing habitat-hectares			??							
Bioregion			VVP	VVP	VVP	VVP	VVP	VVP	VVP	H-SF
EVC conservation status			Endangered	Endangered	Endangered	Endangered	Endangered	Endangered	Endangered	Endangered
Conservation significance										

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Identifiers		Max. score	HZ9	HZ10	HZ11	HZ12	HZ13	HZ14	HZ15	HZ16
EVC benchmark			ES (EVC 895)	FRW (EVC 56)	PGW (EVC 55)	BIF (EVC 61)	BIF (EVC 61)	ES (EVC 895)	PGW (EVC 55)	BIF (EVC61)
Site condition	Large old trees	10	-	9	6	10	10	-	10	10
	Canopy cover	5	5	4	3	5	5	5	5	5
	Understorey	25	15	15	15	15	15	15	15	15
	Lack of weeds	15	0	0	0	0	7	0	0	0
	Recruitment	10	6	10	10	3	3	6	0	3
	Organic litter	5	3	5	0	3	5	3	0	3
	Logs	5	5	5	5	3	5	5	0	0
L'scape	Patch size	10	8	8	8	8	8	8	8	8
	Neighborhood	10	2	2	2	2	2	2	1	2
	Distance to core	5	4	4	4	4	4	4	4	4
HABITAT SCORE %		100	(48/90) = 53*	62	53	53	64	(48/90) = 53*	43	50
Area of the habitat zone (hectares)										
Estimated existing habitat-hectares										
Bioregion			H-SF	H-SF	H-SF	H-SF	H-SF	H-SF	H-SF	H-SF
EVC conservation status			Endangered	Endangered	Endangered	Vulnerable	Vulnerable	Endangered	Endangered	Vulnerable
Conservation significance										

* Scores for habitat polygons within Escarpment Shrubland (EVC 895) have been adjusted to account for the absence of an upper canopy in the benchmark (i.e. score/90).

PGW = Plains Grassy Woodland
VVP = Victorian Volcanic Plain

FRW = Floodplain Riparian Woodland
H-SF = Highlands-Southern Fall

ES = Escarpment Shrubland
BIF = Box Ironbark Forest

EVC conservation status:

Endangered < 10 % of pre-European EVC coverage remains (or a combination of depletion, loss of quality, current threats and rarity that gives a comparable status) (DNRE, 2002b).

Vulnerable 10 - 30% of pre-European EVC coverage remains (or a combination of depletion, loss of quality, current threats and rarity that gives a comparable status) (DNRE, 2002b).

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It is not within the scope of this project to conduct a polygon-by-polygon assessment of likely habitat-hectare values following all works associated with the Grey-headed Flying-fox project. Nor is this necessary as no 'clearance' works are proposed as part of the project. Loosely speaking, though, rehabilitation works conducted for this project should result in an increase of habitat-hectare values – through the component scores of understorey, lack of weeds, recruitment and organic litter – in all degraded parts of the site. The presence of the flying-foxes will probably continue to result in a decrease of habitat-hectare values – through the component scores of large trees and tree canopy cover – in the parts of the site containing roost trees, unless alternative roost structures can be provided in sufficient numbers and of sufficient quality to draw enough flying-foxes away from the trees to make any impact sustainable. Flying-fox impacts will however be more than adequately compensated for as the revegetation/regeneration program develops and the study site's habitat and ecological values are improved.

3.3 Target areas for works

Several management projects and revegetation/rehabilitation project objectives have been determined that consider the requirements and issues identified for sustaining a viable roost site, and bearing in mind the now degraded and deteriorating condition that the current Yarra Bend Park roost site is in. One involves general site-wide weed control, one involves general site-wide revegetation, and the rest are location-specific projects for establishment/rehabilitation of wetlands and revegetation/regeneration of surrounding land.

These projects have been selected for attention because they increase the availability of suitable habitat for the Grey-headed Flying-foxes, whilst also improving the floristic integrity of remnant vegetation sub-communities and EVCs within the Park. The following sections briefly outline the location and rationale for each project – the technicalities involved in conducting these projects are outlined in Sections 4.2.4, 4.2.5 and 4.2.6.

▪ Rehabilitation of the wetland below the current roost site (west of the River)

The colonisation of this current roost position has been partly attributed to the 'wetland' located below the site (DSE, 2004). The negligible size of the wetland compared to the adjacent Yarra River would suggest however that caution be used when making such suggestions, but it may be that the wetland contributes an extra degree of humidity to the microclimate, thus making the roost site marginally more attractive for the flying-foxes. This area has been the main young-rearing area, suggesting that it contains the prime roosting habitat.

The wetland is currently in a highly degraded state within the River's floodplain. In order to restore its function as a wetland, it is suggested that it be rehabilitated as an Aquatic Herbland EVC appropriate to the Victorian Volcanic Plain Bioregion. Any revegetation works on the land surrounding the wetland should be for rehabilitation of the host Floodplain Riparian Woodland EVC appropriate to the Victorian Volcanic Plain Bioregion.

It is extremely important that if any significant works are to be conducted at this site, they be done at times when the flying-foxes are not roosting in the area or densities are low. This is to avoid the potential for disturbing and possibly dispersing the colony away from the site. The possibility of dispersing the colony to other areas of the park or elsewhere is too high to risk so, careful consideration should be given to the timing of works.

▪ Rehabilitation of the stormwater wetland adjacent to current roost site (east of the River)

This wetland is also in a degraded state, though in a different manner to that below the roost on the west of the Yarra River. Some indigenous vegetation cover appropriate for a wetland EVC remains, however the wetland, fed by stormwater from Yarra Boulevard, has been choked by siltation and weeds, and retains no areas of any depth or of open water. In order to restore some variety of habitats to this wetland, it is suggested that it be extended and rehabilitated through careful excavation of areas that retain no indigenous vegetative cover.

Design of this extended wetland is being conducted by other contractors with the intent that it be developed as a focal point for the flying-fox colony and the priority works site of this program. This site will be developed as a chain of wetlands that provide diverse habitat values to the Park's indigenous fauna whilst providing good roosting habitat for Grey-headed Flying-foxes. Artificial roost structures will be erected to compliment the site's extensive upper canopy vegetation and revegetation works at the river's edge will also be conducted to fill gaps in the upper canopy cover. Once developed this site will provide alternate roosting

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options, thereby attracting part of the colony and spreading it out over a larger area, reducing stress on individual roost trees.

As possible, the development design will not involve excavation of areas with relatively good quality indigenous wetland vegetation, and particularly, that it doesn't involve destruction of any surrounding trees. Mature River Red Gum and Silver Wattles s, observed during field works to constitute preferred roost trees in the immediate area, currently surround the wetland. They provide ready-made roosting structures for any flying-foxes that might use this site, and so their preservation must be an essential element of the wetland rehabilitation program essential to the entire point of rehabilitating the wetland in the first place. Scattered immature trees and a nearby cohort of River Red Gums should also be preserved, as these constitute the next generation roost trees.

The newly landscaped wetland should be revegetated as an Aquatic Herbland EVC appropriate to the Highlands-Southern Fall Bioregion. Any revegetation works on the land surrounding the wetland should be for rehabilitation of the host Plains Grassy Woodland EVC appropriate to the Highlands-Southern Fall Bioregion.

▪ **Rehabilitation of floodplain and riparian vegetation at the ropes course**

This site is sheltered to some degree from south-easterly winter winds by the natural embankment to the west. This site also retains much of its indigenous upper and middle canopy vegetation requiring only groundstorey weed control works and substitution plantings of species suitable to the site's Floodplain Riparian Woodland EVC to close gaps in the vegetative cover.

Surrounding vegetation is already in a good condition, but further works could be conducted, and should be for rehabilitation of the host Floodplain Riparian Woodland EVC appropriate to the Victorian Volcanic Plain Bioregion.

▪ **Rehabilitation of vegetation, and possible construction of wetland, at the northern end of site**

The northern end of the site provides the most extensive stretch of relatively flat-lying land on-site, and allows the most space, should funds be available, for the possible future development of a wetland, if required. A low-lying terrace of Plains Grassy Woodland EVC provides relatively open space through which the beginnings of the wetland could run (this should be constructed to avoid healthy stands of indigenous grasses), but the open nature of this environment means that the flying-foxes might not utilise the scattered mature River Red Gums at the higher end of the slope for roosting. At the lower end of the slope, though, the Plains Grassy Woodland fringes Floodplain Riparian Woodland EVC, where the terrace drops gently into the floodplain. Many more mature trees at this fringe provide a more sheltered environment, suitable for the flying-foxes, and the floodplain is covered by a blanket of weedy understorey, allowing for an opening out of the wetland. The floodplain is wider here than anywhere else on-site, and provides good opportunity for construction of additional wetlands to extend the range of humid environments.

This proposal is dependent on funds and should be considered after development of the current roost site and the eastern wetland have been completed and the level of success evaluated. There is also potential to involve VicRoads, in a jointly funded program, in the wetland treatment of stormwater run-off from the nearby Eastern Freeway.

Any wetland should be constructed so as to avoid damage to any indigenous vegetation – particular care should be taken on the Plains Grassy Woodland terrace to mark out stands of indigenous grasses for protection from excavation/ vehicular movement. The wetland should be revegetated to imitate an Aquatic Herbland EVC appropriate to the Victorian Volcanic Plain Bioregion. Any revegetation works on the land surrounding the wetland should be for rehabilitation of: (i) the host Plains Grassy Woodland EVC appropriate to the Victorian Volcanic Plain Bioregion on the terrace; and (ii) the host Floodplain Riparian Woodland EVC appropriate to the Victorian Volcanic Plain Bioregion in the floodplain.

▪ **Revegetation of open gaps in indigenous vegetation cover**

Areas throughout the site were found to contain insufficient indigenous vegetation cover to warrant habitat-hectare assessment. These areas are shown in Figure 2, 'Habitat-hectare polygons' as the areas not assigned as a HZ polygon, and, according to Beardsell's mapping, once constituted Plains Grassy Woodland in the north of the site and Escarpment Shrubland in the northwest of the site (Beardsell 2003). There is an opportunity here to plant species appropriate to the site's EVCs that will rapidly establish an upper canopy for flying-fox roosting. These open areas however are further from the Rivers edge and may therefore not be

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favourable to the Grey-headed Flying-foxes, but may provide roosting opportunities when the colony increases in size during the summer/autumn influx.

Much of the degraded Escarpment Shrubland in the northwest of the site has already undergone extensive planting of tree and shrub species, so it is recommended that interstitial space be filled with groundstorey species of an Escarpment Shrubland EVC appropriate to the Victorian Volcanic Plain Bioregion.

The degraded Plains Grassy Woodland in the north of the site seems to have been left as is in its cleared state, with only weed control works being conducted in the area. Revegetation here should be for rehabilitation of a Plains Grassy Woodland EVC appropriate to the Victorian Volcanic Plain Bioregion.

Smaller revegetation programs should also be undertaken across the whole site, in areas that, though not nearly as degraded as those mentioned above, are nevertheless missing habitat elements such as upper, middle or groundstorey cover. Revegetation works should aim to restore environments so that they more closely resemble pre-European EVCs, by referring to the area's appropriate EVC and Bioregion (as indicated on Figure 1, 'Floristic communities of the northern reach of Yarra Bend Park (Beardsell 2003)'), and planting species selected from any life forms that the area lacks or only contains in greatly reduced numbers. In this way gaps in the upper canopy in particular can be filled to further extend the available roost habitat and improve biodiversity.

▪ **Weed control across the site**

Ongoing weed control across the site is vital for keeping invasive weed species in check, for maximising the success of indigenous vegetation planting programs, and for allowing natural regeneration of indigenous plant species. Constant diligence can be costly, but by maximising indigenous vegetation regeneration and minimising the possibility of uncontrollable weed infestations, it can actually minimise both environmental and economic costs. Yarra Bend Park has benefited from such ongoing vigilance under the management of Parks Victoria, and funding tied to the Grey-headed Flying-fox project now allows for expansion of the weed control program to include weed species that, though not the subject of legislation, are nevertheless highly invasive and proving to be problematic across the whole site.

3.4 Weed control methods

Yarra Bend Park's *Environmental Action Plan* (Parks Victoria 2000) documents that approximately 381 exotic plant species have been recorded within the Park and, that of these, 61 weed species are considered to be of particular concern due to their invasive nature. There are 19 species listed as 'regionally controlled' under the *Catchment and Land Protection Act 1994* and another 42 are considered to be 'major environmental weeds' (Carr *et al* 1992).

The 19 regionally controlled weeds have been subject to control programs in Yarra Bend Park over the decade preceding this plan, and their spread was reported as being limited by the control programs. More specifically, all regionally controlled infestations were recorded as being either in a static state or decreasing except for that of Three-corner Garlic (*Allium triquetrum*), which, though having its spread limited by control programs, has increased throughout the Park.

The 42 major environmental weeds had not generally been the subject of limiting control programs, and were reported as being on the increase in all parts of Yarra Bend Park.

Field works conducted for this report involved identifying weeds that are currently on-site and that, due to their invasive nature, require control. Control methods are indicated in Appendix 1, 'On-site weeds', along with each weed species legislative status (State and Commonwealth assigned importance of control), current distribution and impact on-site (site-specific importance of control). Appendix 1, 'On-site weeds' should thus guide the weed control programs that will be conducted specifically for the Grey-headed Flying-fox habitat regeneration/revegetation project, but should also help guide ongoing weed control after project works have been completed.

3.5 Integrating weed control, regeneration and revegetation

As detailed above, this plan must address the need to integrate the three different actions of weed control, regeneration and revegetation, in order to best produce the end goal of providing habitat that is dominated by appropriate indigenous species, and is better suited to supporting the Grey-headed Flying-fox colony.

Each year's regeneration/revegetation program on any specific part of the site must include three steps:

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1. Weed control

Initial weed control will involve:

- i. the removal or control of groundstorey weeds from an area to facilitate the regeneration of indigenous plants; and
- ii. spraying of middle canopy woody weeds.

Dead tree stags and dead woody weed trees that may offer potential middle and upper canopy roosting opportunities should be strategically retained. After the onslaught of initial programs, selective weed control by hand weeding and/or spot spraying will be necessary on an ongoing basis.

2. Assessment of regeneration, and design of revegetation

After the initial weed control program, the area should be assessed for what regeneration has occurred. Typically we would expect that 3-6 months after weed control works some of the area involved will be covered with the regeneration of more weeds, some will probably be covered with the regeneration of indigenous trees and shrubs, and it is likely that there will be no, or negligible, regeneration of indigenous groundstorey plants.

A revegetation project for the area should therefore be designed that, amongst other things (see Section 4.2.6 'Revegetation methods', below), takes into account what is already present in the form of mature indigenous specimens and newly regenerated indigenous stock. Indigenous plants found to be already present in the area can be kept off the revegetation list so that the program can concentrate on reintroducing missing species.

Plant ordering then needs to occur so that delivery of adequate amounts of stock from local provenance seed can happen in time for late Winter/early Spring planting. The nursery stock required for planting will change with specific projects: cells will be a useful medium for grasses, sedge, rushes and some herb species; divisions will be the best medium for many wetland species; many trees, shrubs and herbs will only be available in tubes.

3. Further weed control, and implementation of revegetation

To begin the revegetation program, any weeds that have regenerated in the area should undergo further control. Revegetation works can then follow, and should be timed to ensure optimal survival.

The above program is by necessity quite flexible, but involves a process that would need to occur over a period of 8-12 months. An attempt to identify appropriate timing of each step in the process, for the different areas of Yarra Bend Park, is presented below in Section 4.2.8 *Program of works*.

3.6 Revegetation methods

Revegetation templates have been developed for each bioregional EVC found on-site; each template providing a list of indigenous species that are appropriate for revegetation within that EVC. The species lists have been compiled from literature sources including the set of *EVC/Bioregion Benchmark for Vegetation Quality Assessment* sheets (DSE 2004b-j) and *The Vegetation of Yarra Bend Park* (containing vegetation sub-community descriptions and an annotated flora list) (Beardsell, 2003).

The revegetation templates have been devised to ensure that the species planted are appropriate to an area's EVC, and also that the seedling ratios should encourage development of an appropriate canopy structure. It is important to note however that the priority of this program is to provide suitable habitat for the flying-foxes and that, therefore, species selection and planting ratios, within the template, should be biased towards the flying-foxes roost and habitat requirements.

The ratios are calculated on a planting rate of 4 seedlings per square metre and are based on the expected percentage coverage of different life forms, as reported in EVC/Bioregion benchmarks and also in Beardsell's vegetation sub-community descriptions (2003). So, for example, the Plains Grassy Woodland EVC template recommends planting a high ratio of groundstorey species (up to 80%) with a few middle and upper canopy tubes in order to maintain the open woodland nature of this EVC.

Design of revegetation programs for each area should take into account:

- i. the area's host EVC and Bioregion – this determines which template(s) should be used for plant selection (the relevant templates are outlined in an Excel document available from the authors of this

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report, Parks Victoria, Yarra Bend Park or the Department of Sustainability and Environment (Grey-headed Flying-fox Project Manager) in East Melbourne);

- ii. the specific environmental conditions of the area – used to determine which plants are most appropriate (eg. the Floodplain Riparian Woodland EVC hosts some plants that grow best in well-drained parts of the floodplain, and other plants that grow best in sodden parts of the floodplain);
- iii. the existing vegetative cover – to determine which plants can be kept off the revegetation list so that the program can concentrate on reintroducing missing species; and
- iv. the flying-fox's roost and habitat requirements – to ensure the long-term viability of this species and to ensure that this site remains a viable roost location.

In this way 'gaps' within the indigenous floristic landscape can be revegetated without compromising EVC structure. It should be noted that in areas where the Grey-headed Flying-foxes have been roosting, upper canopy trees are currently present in appropriate numbers, but are displaying reduced health due to the presence of the flying-foxes. In these areas, upper canopy trees should be considered almost absent, and so, if also absent as immature specimens, should form part of the planting list.

The density of planting should be at 4-6 plants/m² (depending on the template) and timing of planting should be so as to maximise plant survival i.e. late Winter/early Spring. Outlined in the following table are the areas that were identified, in Section 4.2.3 above, as being particularly suitable for revegetation/regeneration works, and the flora species templates that should be used for each as a basis for construction of planting lists.

Table 3. Sites for rehabilitation works, and corresponding vegetation templates

Target area	Host EVC	Host bioregion
W1 (wetland below current roost site to west of River)	Aquatic Herbland (AH 653)	Victorian Volcanic Plain
R1 (land surrounding W1)	Floodplain Riparian Woodland (FRW 56)	Victorian Volcanic Plain
W2 (stormwater wetland adjacent to current roost site to east of River)	Aquatic Herbland (AH 653)	Victorian Volcanic Plain
R2 (land surrounding W2)	Plains Grassy Woodland (PGW 55)	Highlands-Southern Fall
W3 (wetland for construction at ropes course)	Aquatic Herbland (AH 653)	Victorian Volcanic Plain
R3 (land surrounding W3)	Plains Grassy Woodland (PGW 55)	Victorian Volcanic Plain
W4a (wetland for construction on terrace at northern end of site)	Aquatic Herbland (AH 653)	Victorian Volcanic Plain
R4a (land surrounding W4)	Plains Grassy Woodland (PGW 55)	Victorian Volcanic Plain
W4b (wetland for construction in floodplain at northern end of site)	Aquatic Herbland (AH 653)	Victorian Volcanic Plain
R4b (land surrounding W4)	Floodplain Riparian Woodland (FRW 56)	Victorian Volcanic Plain
Open gaps in indigenous vegetation cover	Varies across site, to be determined for each area from Figure 1.	Varies across site: Victorian Volcanic Plain to west of River, Highlands-Southern Fall to east of River

Templates are available from the authors of this report, Parks Victoria, Yarra Bend Park or the Department of Sustainability and Environment (Grey-headed Flying-fox Project Manager) in East Melbourne)

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Additional templates have been developed for rapid tree cover establishment, and a second for cost effective and rapid establishment of middle canopy habitat. The former is designed to provide rapid roost habitat and the latter to assist with weed control.

It is essential that the application of these templates is conducted with the utmost degree of care taken around already existing indigenous vegetation. This is readily done in the case of mature trees and shrubs, whose presence is obvious – additional care should be taken to mark off indigenous groundstorey so that it is protected from contractors conducting works.

It should also be noted that there are several fast growing tree species listed in the templates that might be suitable for rapid establishment of natural roosting positions, such as the Silver Wattle currently utilised by flying-foxes on-site. It may be appropriate to plant these species in higher densities than specified within the templates at the current roost sites to:

- compensate for expected canopy tree losses associated with roosting; and to
- assist in the appropriation and retention of nutrients brought to the site as bat-droppings.

It is important to note however that template species ratios are adhered to for revegetation programs outside of the roost sites. Whilst a dense monoculture canopy of Silver Wattle might be beneficial for the Grey-headed Flying-fox colony, it is not in keeping with the natural structure of the study area's floristic communities, would not be appropriate habitat for other indigenous fauna, and could prove detrimental to other elements of the vegetative community.

3.7 Program of works

Table 4, below, details a program of works for each of the target areas. Contractors will be required to evaluate site specific conditions and incorporate flexibility in design and implementation.

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Table 4. Program of works

Target area	2004-2005	2005-2006	2006-2007
W1, W2, W3, W4a, W4b	Wetland design and construction Site demarcation and access control Weed control: mechanical removal, spot spraying & handweeding of groundstorey weeds Weed control: drill and frill middle canopy woody weeds; retain potential roost stags Regeneration assessment and revegetation design Revegetation works & application of templates	Development of wetlands (at night-time if necessary) Follow-up weed control: spot spraying & handweeding Regeneration assessment and supplementary revegetation design Follow-up revegetation and completion of the templates Maintenance of previous revegetation works	Maintenance of previous revegetation works On-going diversification of habitat Substitution plantings as required to meet EVC template requirements
R1, R2, R3, R4a, R4b	Weed control: drill and frill, spot spraying & handweeding (leave stags) Regeneration assessment and revegetation design Revegetation works & application of templates	Follow-up weed control: spot spraying & handweeding Regeneration assessment and revegetation design Follow-up revegetation and completion of the templates Maintenance of previous revegetation works	Maintenance of previous revegetation works On-going diversification of habitat Substitution plantings as required to meet EVC template requirements
Open gaps in indigenous vegetation cover	Preliminary groundstorey weed control Revegetation works & application of templates	Application of upper canopy species from the templates Maintenance of previous revegetation works	On-going development of upper canopy species and middle canopy plantings as appropriate to the EVC templates Maintenance of previous revegetation works
Weed control across site	Weed control works across the site focusing on groundstorey	Weed control works across all vegetative canopies	On-going weed control works

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4.0 References

- Beardsell, C. (2003). *The Vegetation of Yarra Bend Park: A Report on the Vegetation Communities and Sub-communities of Yarra Bend Park, Incorporating an Annotated List of Native Vascular Flora*. Parks Victoria, Melbourne.
- Carr, G. W, Yugovic, J. V. and Robinson, K. E. (1992). *Environmental Weed Invasions in Victoria: Conservation and Management Implications*. Department of Conservation and Environment, Melbourne.
- DNRE (2002a). *Horseshoe Bend Management Plan: Development of an Alternative Roost Site for the Grey-headed Flying-fox at Ivanhoe, Victoria*. Report prepared by Robin Crocker and Associates and EDGe Environmental Design for: Department of Natural Resources and Environment, Melbourne.
- DNRE (2002b). *Victoria's Native Vegetation Management: A Framework for Action*. Department of Natural Resources and Environment, Melbourne.
- DNRE (2002c). *Ecological Vegetation Classes (EVCs) and Sites of Biodiversity Significance (BioSites), Port Phillip and Westernport Region: Reports and Maps for Land and Water Management Agencies*. Department of Natural Resources and Environment, Melbourne.
- DSE (2003). *Relocating Flying-foxes (revised edition, June 2003)*. Department of Sustainability and Environment, Melbourne.
- DSE (2004a). *Overview of a Proposal to Implement a Five-year Management plan to establish a sustainable Flying-fox roost site at Yarra Bend Park*. Department of Sustainability and Environment, Melbourne.
- DSE (2004b). *EVC/Bioregion Benchmark for Vegetation Quality Assessment, EVC 55: Plains Grassy Woodland, Victorian Volcanic Plain Bioregion (unpublished)*. Department of Sustainability and Environment, Melbourne.
- DSE (2004c). *EVC/Bioregion Benchmark for Vegetation Quality Assessment, EVC 55: Plains Grassy Woodland, Highlands-Southern Fall Bioregion (unpublished)*. Department of Sustainability and Environment, Melbourne.
- DSE (2004d). *EVC/Bioregion Benchmark for Vegetation Quality Assessment, EVC 56: Floodplain Riparian Woodland, Victorian Volcanic Plain Bioregion (unpublished)*. Department of Sustainability and Environment, Melbourne.
- DSE (2004e). *EVC/Bioregion Benchmark for Vegetation Quality Assessment, EVC 56: Floodplain Riparian Woodland, Highlands-Southern Fall Bioregion (unpublished)*. Department of Sustainability and Environment, Melbourne.
- DSE (2004f). *EVC/Bioregion Benchmark for Vegetation Quality Assessment, EVC 61: Box Ironbark Forest, Highlands-Southern Fall Bioregion (unpublished)*. Department of Sustainability and Environment, Melbourne.
- DSE (2004g). *EVC/Bioregion Benchmark for Vegetation Quality Assessment, EVC 653: Aquatic Herbland, Victorian Volcanic Plain Bioregion (unpublished)*. Department of Sustainability and Environment, Melbourne.
- DSE (2004h). *EVC/Bioregion Benchmark for Vegetation Quality Assessment, EVC 653: Aquatic Herbland, Highlands-Southern Fall Bioregion (unpublished)*. Department of Sustainability and Environment, Melbourne.
- DSE (2004i). *EVC/Bioregion Benchmark for Vegetation Quality Assessment, EVC 895: Escarpment Shrubland, Victorian Volcanic Plain Bioregion (unpublished)*. Department of Sustainability and Environment, Melbourne.
- DSE (2004j). *EVC/Bioregion Benchmark for Vegetation Quality Assessment, EVC 895: Escarpment Shrubland, Highlands-Southern Fall Bioregion (unpublished)*. Department of Sustainability and Environment, Melbourne.
- Kern, L. (2002). *Horseshoe Bend Vegetation Management Plan: Revegetation/regeneration Plan For The Alternative Roosting Site For The Grey-headed Flying-fox at Horseshoe Bend, Ivanhoe*. Report prepared for the Department of Natural Resources and Environment, Melbourne.
- KMC (1999). *Ku-ring-gai Flying-fox Reserve Management Plan*. Ku-ring-gai Municipal Council.

Revegetation/Regeneration Plan for Grey-headed Flying-fox Habitat at Yarra Bend Park, Victoria

Oates, A and Taranto, M. (2001). *Vegetation Mapping of the Port Phillip & Westernport Region*. Department of Conservation and Natural Resources, Melbourne.

Parke, D., Newell, G. and Cheal, D. (2003). 'Assessing the quality of native vegetation: The 'habitat hectares' approach', *Ecological Management & Restoration* 4: S29-S38.

Parks Victoria (2000). *Yarra Bend Park: Environmental Action Plan*. Parks Victoria, Melbourne.

Tidemann, C.R. (1999). 'Biology and management of the Grey-headed Flying-fox, *Pteropus poliocephalus*', *Acta Chiropterologica* 1: 151-164.

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Appendix 1. On-site weeds

Please note that where herbicides have been recommended for weed control, only approved herbicides for specific weeds should be used. The personnel or contractor undertaking the works can investigate this issue in greater detail at the time of works to ensure that they adhere to label recommendations.

Weed species and/or groups	Site distribution and impact	Control methods
* <i>Chrysanthemoides monilifera</i> Boneseed	Occurs as scattered, young individuals throughout the site. Should be controlled as a matter of urgency, as this species is capable of completely dominating invaded habitats, eliminating most indigenous groundcover and most regeneration of indigenous overstorey.	Carefully dig seedlings and small plants, removing roots. Any larger plants should be treated by the cut-paint method.
* <i>Crataegus monogyna</i> Hawthorn * <i>Lycium ferocissimum</i> African Box-thorn * <i>Ulex europaeus</i> Gorse * <i>Cytisus scoparius</i> English Broom * <i>Genista linifolia</i> Flax-leaf Broom	Occurs as scattered seedlings and some mature individuals throughout the site. The majority of mature Hawthorn plants have been treated successfully, leaving stags for habitat and root-balls for riverbank stabilisation, however, follow up seedling control is required.	Any remaining shrubs should be treated using the cut-paint or the drill-fill method: <ul style="list-style-type: none">• during the growing season and before fruit ripens (Hawthorn)• when there is good foliage cover (African Box-thorn). Any seedlings regenerating in the future should be carefully dug out, removing roots.
* <i>Rubus fruticosus</i> spp. agg. Blackberry	Some seedlings found scattered throughout the site, restricted to shadier areas and within drier reaches of VVP Plains Grassy Woodland remnants. Largely under control due to Parks Victoria control program.	Spot spray with a broad-leaf specific herbicide, such as Garlon 600 or Brushoff, using a surfactant. Hand removal or brushcutting, taking care to grub out root-balls, may be necessary to avoid off target spray damage within or nearby remnants.
* <i>Vinca major</i> Blue Periwinkle	Mostly contained to one large infestation at the northern western reach of the River which has recently been sprayed. Favours the fertile soils of the lower, shady floodplain and River embankments.	Hand pull or grub out small infestations taking care to remove all stem pieces and growth nodes. Spot spray with non-selective or selective herbicides during the warmer months.
* <i>Allium triquetrum</i> Three-corner Garlic	Found throughout the site but largely isolated to damp, shaded areas within the lower floodplain and the disturbed fringes of woodland remnants. Tenacious species capable of dominating the ground-flora once established.	Carefully dig plants, removing all bulbs and cutting and bagging stems if seeds have developed. Slash stands, to ground level, at bulb exhaustion phase (during early flowering period), with a second treatment if reflowering occurs. Needs repeating in subsequent years, and then, as stands thin out, other control methods can be adopted. Spray with selective or non-selective herbicides at bulb exhaustion phase in late winter-early spring, with repeat applications over 2-4 seasons.
* <i>Oxalis pes-caprae</i> Sourb	Aggressive and persistent species completely dominating large areas of the ground-flora throughout the study area eradicating most of the indigenous	Avoid soil disturbance during control efforts. Requires a 2-5 year spray program using selective or non-selective

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Weed species and/or groups	Site distribution and impact	Control methods
	herbaceous species on site; particularly within the Plains Grassy and Floodplain Riparian Woodland remnants. Foliage emerges mid-winter, plants producing 10-50 subsoil bulbils each season over late winter-spring	herbicides <i>at bulb exhaustion phase</i> . Hand-held weed burners can be used to wilt plants at bulb exhaustion phase to prevent nutrients (used to produce flowerheads) returning to bulbs. Requires timed, repeat burning over a 3-5 years period to exhaust nutrients and to control seed germinants (stimulated by burning).
* <i>Nassella trichotoma</i> Serrated Tussock * <i>Nassella neesiana</i> Chilean Needlegrass	Both these species have been well controlled within the Park. Now isolated to drier areas within the VVP Plains Grassy Woodlands (particularly within HZ1). These highly invasive species will rapidly dominate disturbed woodlands if not rapidly brought under control.	Carefully hand dig tussocks taking care to firstly bag and remove seed-heads and stems. The presence of cleistogenes means no plant material should be left on site. Spot spray with non-selective or grass-selective herbicides during the autumn/winter growth season. Burn larger infestations and treat regrowth with herbicides 4-8 weeks later.
* <i>Briza maxima</i> Large Quaking-grass * <i>Briza minor</i> Lesser Quaking-grass	Found throughout the site, particularly in the sunnier, drier areas of Plains Grassy Woodland remnants. Establishes rapidly with the majority of seed germinating in the first season and some remaining dormant for 2-3 years (requires a 3-5 year control program).	Slash stands, close to ground level, with catcher mowers only if seedheads are not yet ripe. Use a hand-held gas burner to burn-off ripe seedheads in spring-early summer <i>before</i> seed release. Follow-up burning of germinants is required. Spray with non- or grass-selective herbicides before flowering, autumn-winter. Check treated area at 4-8 weeks.
* <i>Cynodon dactylon</i> Couch * <i>Pennisetum clandestinum</i> Kikuyu * <i>Agrostis capillaris</i> Brown-top Bent * <i>Dactylis glomerata</i> Cocksfoot	These grass species are found throughout the site forming dense ground covering mats that dominate the ground-flora and prohibit germination or development of seedlings. Control over at least two growing seasons is required to eliminate large infestations of these species.	Carefully dig small infestations, removing all rhizomes and stolons, bagging stems if plants are in seed. Solarise in sunny locations over 4-12 weeks in summer, and follow with spraying of regrowth at 5-10 cm for Couch or at 10-20 cm for Kikuyu. Spray with non-selective or grass-selective herbicides with repeat applications. Hand application of herbicides, using dabber bottles or wick-wipers, can be effective in remnants if applied immediately following ground removal of the plant crown.
* <i>Ehrharta erecta</i> Panic Veldt-grass * <i>Ehrharta longiflora</i> Annual Veldt-grass	These aggressive and rapidly establishing species are found throughout the site often dominating large areas of the groundstorey, seriously impeding the growth and establishment of indigenous ground-flora.	Carefully dig small infestations, removing all rhizomes. Hot burn large infestations, and follow with control of regrowth at 4-6 weeks. Spray with non-selective or grass-selective herbicides before flowering in autumn-winter. Check treated area at 4-8 weeks with follow-up treatments.
* <i>Phalaris aquatica</i> Toowoomba Canary-grass	Very robust plant preferring moist shaded sites, found throughout the study area. Develops deep, extensive root systems and dominates ground-	Smaller plants can be dug out, bagging stems and seed heads first. Spraying with non-selective or grass-

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Weed species and/or groups	Site distribution and impact	Control methods
	<p>flora severely impeding overstorey development.</p> <p>Dense stands increase the ground level biomass and can significantly increase fuel loads.</p>	<p>selective herbicides in winter/spring is an option although it may be necessary to slash areas prior to seed set first. Repeat applications are required.</p> <p>Fire control is an option over 3-5 seasons <i>if</i> the fuel load levels are containable.</p>
<p>Ripgut Brome *<i>Bromus catharticus</i> *<i>Romulea rosea</i> Onion Grass *<i>Plantago lanceolata</i> Ribwort *<i>Solanum</i> spp. Nightshade Creeping Buttercup *<i>Ranunculus repens</i>, Great Dock *<i>Rumex crispus</i> Sow Thistle *<i>Sonchus asper</i></p>	<p>These groundstorey weeds tend to dominate the ground-flora where Phalaris and the Veldt-grasses do not.</p> <p>These, and several more species, often dominate open, grassy areas.</p>	<p>Areas with this diversity of weeds can mostly be controlled through spot spraying with Roundup Biactive. However, a few of the more resistant broadleaf weeds, Creeping Buttercup and Dock, usually require a broadleaf-specific herbicide.</p>
<p>Tradescantia *<i>Tradescantia albiflora</i> *<i>Tradescantia fluminensis</i></p>	<p>Found dotted throughout the reserve but largely contained to the damp, shaded areas within the low lying floodplain and Floodplain Riparian Woodland remnants.</p> <p>On-going control efforts by Parks Victoria has effectively restricted the spread of this species.</p>	<p>Spot spraying with herbicides such as Starane or Roundup Biactive with surfactant is effective but follow-up measures over several years are essential taking care to remove all regrowth or remaining plant segments.</p> <p>Solarisation can be effective in hotter months, removing regrowth by hand once sheeting is lifted.</p>
<p>Box Maple *<i>Acer negundo</i> Desert Ash *<i>Fraxinus angustifolia</i> *<i>Fraxinus excelsior</i> English Ash *<i>Salix babylonica</i> Weeping Willow *<i>Olea europaea</i> Olive</p>	<p>These woody weeds area scattered throughout the site, particularly along the riverbank and low lying floodplain areas.</p>	<p>These species will require different approaches depending on their size:</p> <ul style="list-style-type: none"> - Handweed or spot spray small germinants; - Cut and paint stems of larger shrub size specimens; and - Drill and fill larger trees with required follow-up over time. <p>Treatments work best in early autumn and stags can be left as potential roosts and middle canopy bird habitat.</p>

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Appendix 2. HSF Plains Grassy Woodland (EVC 55) Benchmark

Description:

An open, eucalypt woodland to 15 m tall occurring on a number of geologies and soil types. Occupies poorly drained, fertile soils on flat or gently undulating plains at low elevations. The understorey consists of a few sparse shrubs over a species-rich grassy and herbaceous ground layer.

Large trees:

Species	DBH(cm)	#/ha
<i>Eucalyptus</i> spp.	80 cm	10 / ha

Tree Canopy Cover:

%cover	Character Species	Common Name
20%	<i>Eucalyptus camaldulensis</i>	River Red-gum

Understorey:

Life form	#Spp	%Cover	LF code
Immature Canopy Tree		5%	IT
Understorey Tree or Large Shrub	1	5%	T
Medium Shrub	2	10%	MS
Small Shrub	1	1%	SS
Prostrate Shrub	1	1%	PS
Large Herb	1	5%	LH
Medium Herb	10	20%	MH
Small or Prostrate Herb	3	5%	SH
Large Tufted Graminoid	2	5%	LTG
Large Non-tufted Graminoid	1	10%	LNG
Medium to Small Tufted Graminoid	9	35%	MTG
Medium to Tiny Non-tufted Graminoid	2	10%	MNG
Bryophytes/Lichens	na	10%	BL

LF Code	Species typical of at least part of EVC range	Common Name
T	<i>Allocasuarina littoralis</i>	Black Sheoak
MS	<i>Kunzea ericoides</i>	Burgan
SS	<i>Pimelea humilis</i>	Common Rice-flower
PS	<i>Bossiaea prostrata</i>	Creeping Bossiaea
MH	<i>Hypericum gramineum</i>	Small St John's Wort
MH	<i>Oxalis perennans</i>	Grassland Wood-sorrel
SH	<i>Dichondra repens</i>	Kidney-weed
SH	<i>Poranthera microphylla</i>	Small Poranthera
LTG	<i>Austrostipa rudis</i>	Veined Spear-grass
LNG	<i>Gahnia radula</i>	Thatch Saw-sedge
MTG	<i>Themeda triandra</i>	Kangaroo Grass
MTG	<i>Carex breviculmis</i>	Common Grass-sedge
MTG	<i>Lomandra filiformis</i>	Wattle Mat-rush
MTG	<i>Schoenus apogon</i>	Common Bog-sedge
MNG	<i>Microlaena stipoides</i> var. <i>stipoides</i>	Weeping Grass

Recruitment:

Continuous

Organic Litter:

10 % cover

Logs:

10 m/0.1 ha.

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Weediness:

LF Code	Typical Weed Species	Common Name	Invasive	Impact
LH	<i>Plantago lanceolata</i>	Ribwort	high	low
MH	<i>Hypochoeris radicata</i>	Cat's Ear	high	low
MH	<i>Centaureum erythraea</i>	Common Centaury	high	low
LNG	<i>Holcus lanatus</i>	Yorkshire Fog	high	high
MTG	<i>Anthoxanthum odoratum</i>	Sweet Vernal-grass	high	high
MNG	<i>Romulea rosea</i>	Onion Grass	high	low
MNG	<i>Briza maxima</i>	Large Quaking-grass	high	low
MNG	<i>Briza minor</i>	Lesser Quaking-grass	high	low

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Appendix 3. HSF Floodplain Riparian Woodland (EVC 56) Benchmark

Description:

An open eucalypt woodland to 15 m tall over a medium to tall shrub layer with a ground layer consisting of amphibious and aquatic herbs and sedges. Occurs along the banks and floodplains of the larger meandering rivers and major creeks, often in conjunction with one or more floodplain wetland communities. Elevation and rainfall are relatively low and soils are fertile alluviums subject to periodic flooding and inundation.

Large trees:

Species	DBH(cm)	#/ha
<i>Eucalyptus</i> spp.	80 cm	15 / ha

Tree Canopy Cover:

%cover	Character Species	Common Name
20%	<i>Eucalyptus ovata</i>	Swamp Gum
	<i>Eucalyptus viminalis</i>	Manna Gum

Understorey:

Life form	#Spp	%Cover	LF code
Immature Canopy Tree		5%	IT
Understorey Tree or Large Shrub	4	15%	T
Medium Shrub	3	10%	MS
Large Herb	4	10%	LH
Medium Herb	3	10%	MH
Small or Prostrate Herb	2	5%	SH
Large Tufted Graminoid	3	15%	LTG
Large Non-tufted Graminoid	3	20%	LNG
Medium to Small Tufted Graminoid	5	15%	MTG
Medium to Tiny Non-tufted Graminoid	1	5%	MNG
Scrambler or Climber	3	10%	SC
Bryophytes/Lichens	na	10%	BL

LF Code	Species typical of at least part of EVC range	Common Name
T	<i>Acacia dealbata</i>	Silver Wattle
T	<i>Melaleuca ericifolia</i>	Swamp Paperbark
T	<i>Acacia melanoxylon</i>	Blackwood
MS	<i>Bursaria spinosa ssp. spinosa</i>	Sweet Bursaria
MS	<i>Hymenanthera dentata</i> s.l.	Tree Violet
LH	<i>Senecio quadridentatus</i>	Cotton Fireweed
LH	<i>Senecio minimus</i>	Shrubby Fireweed
LH	<i>Senecio pinnatifolius</i>	Variable Groundsel
MH	<i>Acaena novae-zelandiae</i>	Bidgee-widgee
MH	<i>Crassula helmsii</i>	Swamp Crassula
MH	<i>Persicaria decipiens</i>	Slender Knotweed
SH	<i>Dichondra repens</i>	Kidney-weed
LTG	<i>Juncus sarophorus</i>	Broom Rush
LTG	<i>Juncus gregiflorus</i>	Green Rush
LTG	<i>Carex appressa</i>	Tall Sedge
LTG	<i>Poa labillardierei</i>	Common Tussock-grass
LNG	<i>Phragmites australis</i>	Common Reed
LNG	<i>Schoenoplectus tabernaemontani</i>	River Club-sedge
MTG	<i>Juncus amabilis</i>	Hollow Rush
MTG	<i>Carex inversa</i>	Knob Sedge
MNG	<i>Microlaena stipoides</i> var. <i>stipoides</i>	Weeping Grass
SC	<i>Calystegia sepium</i>	Large Bindweed

Recruitment:

Episodic/Flood. Desirable period between disturbances is 10 years.

Organic Litter:

40 % cover

Logs:

30 m/0.1 ha.

Weediness:

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LF Code	Typical Weed Species	Common Name	Invasive	Impact
T	<i>Fraxinus angustifolia</i> ssp. <i>angustifolia</i>	Desert Ash	high	high
T	<i>Salix fragilis</i>	Crack Willow	high	high
T	<i>Salix cinerea</i>	Grey Sallow	high	high
T	<i>Crataegus monogyna</i>	Hawthorn	high	high
MS	<i>Solanum pseudocapsicum</i>	Madeira Winter-cherry	high	high
MS	<i>Prunus cerasifera</i>	Cherry Plum	high	high
LH	<i>Cirsium vulgare</i>	Spear Thistle	high	high
LH	<i>Solanum americanum</i>	Glossy Nightshade	high	high
LH	<i>Plantago lanceolata</i>	Ribwort	high	low
LH	<i>Rorippa palustris</i>	Marsh Yellow-cress	high	high
LH	<i>Sonchus asper</i> s.l.	Rough Sow-thistle	high	low
LH	<i>Verbena bonariensis</i> s.l.	Purple-top Verbena	high	high
LH	<i>Aster subulatus</i>	Aster-weed	high	low
LH	<i>Rumex pulcher</i> ssp. <i>pulcher</i>	Fiddle Dock	high	low
LH	<i>Rumex crispus</i>	Curled Dock	high	high
LH	<i>Rumex conglomeratus</i>	Clustered Dock	high	high
LH	<i>Echium plantagineum</i>	Paterson's Curse	high	high
MH	<i>Hypochoeris radicata</i>	Cat's Ear	high	low
MH	<i>Ranunculus repens</i>	Creeping Buttercup	high	high
MH	<i>Anagallis arvensis</i>	Pimpernel	high	low
MH	<i>Arctotheca calendula</i>	Cape Weed	high	low
MH	<i>Gamochaeta purpurea</i> s.l.	Purple Cudweed	high	low
MH	<i>Lotus corniculatus</i>	Bird's-foot Trefoil	high	low
MH	<i>Atriplex prostrata</i>	Hastate Orache	high	low
MH	<i>Stellaria media</i>	Chickweed	high	low
SH	<i>Trifolium repens</i> var. <i>repens</i>	White Clover	high	low
SH	<i>Modiola caroliniana</i>	Red-flower Mallow	high	low
SH	<i>Callitriche stagnalis</i>	Common Starwort	high	low
LTG	<i>Phalaris aquatica</i>	Toowoomba Canary-grass	high	high
LNG	<i>Holcus lanatus</i>	Yorkshire Fog	high	high
LNG	<i>Pennisetum clandestinum</i>	Kikuyu	high	high
MTG	<i>Iris pseudacorus</i>	Yellow Flag Iris	high	high
MTG	<i>Paspalum dilatatum</i>	Paspalum	high	high
MTG	<i>Lolium perenne</i>	Perennial Rye-grass	high	high
MTG	<i>Cyperus eragrostis</i>	Drain Flat-sedge	high	high
MTG	<i>Anthoxanthum odoratum</i>	Sweet Vernal-grass	high	high
MTG	<i>Agrostis stolonifera</i>	Creeping Bent	high	high
MTG	<i>Setaria gracilis</i> var. <i>pauciseta</i>	Slender Pigeon Grass	high	low
MTG	<i>Bromus catharticus</i>	Prairie Grass	high	low
MTG	<i>Poa annua</i>	Annual Meadow-grass	high	low
MTG	<i>Lolium rigidum</i>	Wimmera Rye-grass	high	low
MTG	<i>Ehrharta erecta</i> var. <i>erecta</i>	Panic Veldt-grass	high	high
MTG	<i>Agrostis capillaris</i> s.l.	Brown-top Bent	high	high
MNG	<i>Dactylis glomerata</i>	Cocksfoot	high	high
MNG	<i>Leersia oryzoides</i>	Rice Cut-grass	high	high
MNG	<i>Paspalum distichum</i>	Water Couch	high	high
MNG	<i>Poa pratensis</i>	Kentucky Blue-grass	high	high
SC	<i>Rubus</i> sp. aff. <i>armeniacus</i>	Blackberry	high	high
SC	<i>Vinca major</i>	Blue Periwinkle	high	high
SC	<i>Tradescantia fluminensis</i>	Wandering Jew	high	high
SC	<i>Galium aparine</i>	Cleavers	high	low

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Appendix 4. HSF Box Ironbark Forest (EVC 61) Benchmark

Description:

Occurs on gently undulating rises, low hills and peneplains on infertile, often stony soils derived from a range of geologies. The open overstorey to 20 m tall consists of a variety of eucalypts, often including one of the Ironbark species. The mid storey often forms a dense to open small tree or shrub layer over an open ground layer ranging from a sparse to well-developed suite of herbs and grasses.

Large trees:

Species	DBH(cm)	#/ha
<i>Eucalyptus</i> spp.	70 cm	15 / ha

Tree Canopy Cover:

%cover	Character Species	Common Name
30%	<i>Eucalyptus polyanthemos</i>	Red Box
	<i>Eucalyptus macrorhyncha</i>	Red Stringybark
	<i>Eucalyptus gonioocalyx</i> s.l.	Bundy
	<i>Eucalyptus tricarpa</i>	Red Ironbark

Understorey:

Life form	#Spp	%Cover	LF code
Immature Canopy Tree		5%	IT
Medium Shrub	4	20%	MS
Small Shrub	3	10%	SS
Prostrate Shrub	2	1%	PS
Large Herb	2	5%	LH
Medium Herb	10	15%	MH
Small or Prostrate Herb	2	1%	SH
Large Tufted Graminoid	1	1%	LTG
Medium to Small Tufted Graminoid	5	10%	MTG
Ground Fern	1	1%	GF
Bryophytes/Lichens	na	10%	BL
Soil Crust	na	20%	S/C
Total understorey projective foliage cover		80%	

LF Code	Species typical of at least part of EVC range	Common Name
MS	<i>Acacia genistifolia</i>	Spreading Wattle
MS	<i>Pultenaea gunnii</i>	Golden Bush-pea
MS	<i>Kunzea ericoides</i>	Burgan
MS	<i>Cassinia aculeata</i>	Common Cassinia
SS	<i>Dillwynia phyllicoides</i>	Small-leaf Parrot-pea
SS	<i>Leucopogon virgatus</i>	Common Beard-heath
SS	<i>Dillwynia cinerascens</i> s.l.	Grey Parrot-pea
PS	<i>Acrotriche serrulata</i>	Honey-pots
LH	<i>Senecio tenuiflorus</i>	Slender Fireweed
LH	<i>Wahlenbergia stricta</i>	Tall Bluebell
MH	<i>Gonocarpus tetragynus</i>	Common Raspwort
MH	<i>Glossodia major</i>	Wax-lip Orchid
MH	<i>Drosera peltata</i> ssp. <i>auriculata</i>	Tall Sundew
MH	<i>Poranthera microphylla</i>	Small Poranthera
SH	<i>Opercularia varia</i>	Variable Stinkweed
SH	<i>Hydrocotyle laxiflora</i>	Stinking Pennywort
LNG	<i>Gahnia radula</i>	Thatch Saw-sedge
MTG	<i>Joycea pallida</i>	Silvertop Wallaby-grass
MTG	<i>Lomandra filiformis</i> ssp. <i>filiformis</i>	Wattle Mat-rush
MTG	<i>Lomandra nana</i>	Dwarf Mat-rush
MTG	<i>Dianella revoluta</i> s.l.	Black-anther Flax-lily
SC	<i>Thysanotus patersonii</i>	Twining Fringe-lily

Recruitment:

Continuous

Organic Litter:

20 % cover

Logs:

20 m/0.1 ha.

Weediness:

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LF Code	Typical Weed Species	Common Name	Invasive	Impact
MH	<i>Hypochoeris radicata</i>	Cat's Ear	high	low
MTG	Briza maxima	Large Quaking-grass	high	low

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Appendix 5. HSF Escarpment Shrubland (EVC 895) Benchmark

Description:

Occurs on rocky escarpments in steep valleys or gorges, associated with limestone or basalt. Sites have moderate to high fertility, are well-drained but subject to regular summer drought due to shallow soils. . Eucalypt woodland to 15 m tall or non-eucalypt shrubland to 8 m tall, with occasional eucalypts; lichen-covered rock outcrops are common.

+ eucalypt woodland only components (ignore when assessing shrubland areas and standardise site condition score as required)

Tree Canopy Cover:

%cover	Character Species	Common Name
15%	<i>Acacia implexa</i>	Lightwood
	<i>Allocasuarina verticillata</i>	Drooping Sheoak
	<i>Acacia mearnsii</i>	Black Wattle
	<i>Bursaria spinosa</i>	Sweet Bursaria
	<i>Eucalyptus radiata</i>	Narrow-leaf Peppermint

Understorey:

Life form	#Spp	%Cover	LF code
Immature Canopy Tree*		5%	IT
Understorey Tree or Large Shrub*	3	10%	T
Medium Shrub	3	10%	MS
Small Shrub	2	5%	SS
Large Herb	3	5%	LH
Medium Herb	4	10%	MH
Small or Prostrate Herb	5	5%	SH
Large Tufted Graminoid	1	5%	LTG
Large Non-tufted Graminoid	1	5%	LNG
Medium to Small Tufted Graminoid	9	25%	MTG
Medium to Tiny Non-tufted Graminoid	3	5%	MNG
Ground Fern	1	5%	GF
Scrambler or Climber	1	5%	SC
Bryophytes/Lichens	na	20%	BL
Soil Crust	na	10%	S/C

LF Code	Species typical of at least part of EVC range	Common Name
MS	<i>Rhagodia parabolica</i>	Fragrant Saltbush
MS	<i>Hymenanthera dentata</i> s.l.	Tree Violet
SS	<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	Ruby Saltbush
LH	<i>Wahlenbergia communis</i> s.l.	Tufted Bluebell
MH	<i>Oxalis perennans</i>	Grassland Wood-sorrel
MH	<i>Maireana enchylaenoides</i>	Wingless Bluebush
MH	<i>Einadia nutans</i> ssp. <i>nutans</i>	Nodding Saltbush
SH	<i>Chamaesyce drummondii</i>	Flat Spurge
SH	<i>Dichondra repens</i>	Kidney-weed
LTG	<i>Austrostipa bigeniculata</i>	Knead Spear-grass
MTG	<i>Austrodanthonia racemosa</i> var. <i>racemosa</i>	Stiped Wallaby-grass
MTG	<i>Austrodanthonia setacea</i>	Bristly Wallaby-grass
MNG	<i>Panicum effusum</i>	Hairy Panic
GF	<i>Cheilanthes distans</i>	Bristly Cloak-fern
SC	<i>Clematis microphylla</i>	Small-leaved Clematis
SC	<i>Convolvulus erubescens</i> spp. agg.	Pink Bindweed

Recruitment:

Continuous

Organic Litter:

20 % cover

Logs:

15 m/0.1 ha⁺.

5 m/0.1 ha. (note: large log class does not apply)

Weediness:

LF Code	Typical Weed Species	Common Name	Invasive	Impact
T	<i>Schinus molle</i>	Pepper Tree	high	high

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MS	<i>Lycium ferocissimum</i>	African Box-thorn	high	high
MS	<i>Genista monspessulana</i>	Montpellier Broom	high	high
SS	<i>Marrubium vulgare</i>	Horehound	high	high
LH	<i>Sonchus oleraceus</i>	Common Sow-thistle	high	low
LH	<i>Helminthotheca echioides</i>	Ox-tongue	high	low
LH	<i>Lactuca serriola</i>	Prickly Lettuce	high	low
LH	<i>Sisymbrium officinale</i>	Hedge Mustard	high	high
LH	<i>Sonchus asper</i> s.l.	Rough Sow-thistle	high	low
LH	<i>Verbascum thapsus</i> ssp. <i>thapsus</i>	Great Mullein	high	high
LH	<i>Echium plantagineum</i>	Paterson's Curse	high	high
LH	<i>Centaurium tenuiflorum</i>	Slender Centaury	high	low
LH	<i>Foeniculum vulgare</i>	Fennel	high	high
MH	<i>Hypochoeris radicata</i>	Cat's Ear	high	low
MH	<i>Trifolium arvense</i> var. <i>arvense</i>	Hare's-foot Clover	high	low
MH	<i>Trifolium subterraneum</i>	Subterranean Clover	high	low
MH	<i>Trifolium campestre</i> var. <i>campestre</i>	Hop Clover	high	low
MH	<i>Trifolium angustifolium</i> var. <i>angustifolium</i>	Narrow-leaf Clover	high	low
MH	<i>Lotus suaveolens</i>	Hairy Bird's-foot Trefoil	high	low
MH	<i>Cerastium glomeratum</i> s.l.	Common Mouse-ear Chickweed	high	low
SH	<i>Medicago polymorpha</i>	Burr Medic	high	low
SH	<i>Trifolium glomeratum</i>	Cluster Clover	high	low
SH	<i>Modiola caroliniana</i>	Red-flower Mallow	high	low
SH	<i>Aptenia cordifolia</i>	Heart-leaf Ice-plant	high	high
LNG	<i>Phalaris aquatica</i>	Toowoomba Canary-grass	high	high
LNG	<i>Holcus lanatus</i>	Yorkshire Fog	high	high
LNG	<i>Avena fatua</i>	Wild Oat	high	low
MTG	<i>Nassella trichotoma</i>	Serrated Tussock	high	high
MTG	<i>Ehrharta longiflora</i>	Annual Veldt-grass	high	low
MTG	<i>Briza maxima</i>	Large Quaking-grass	high	low
MTG	<i>Bromus hordeaceus</i> ssp. <i>hordeaceus</i>	Soft Brome	high	low
MTG	<i>Sporobolus africanus</i>	Rat-tail Grass	high	high
MTG	<i>Vulpia bromoides</i>	Squirrel-tail Fescue	high	low
MTG	<i>Romulea rosea</i>	Onion Grass	high	low
MTG	<i>Pentaschistis airoides</i> ssp. <i>airoides</i>	False Hair-grass	high	low
MTG	<i>Lolium perenne</i>	Perennial Rye-grass	high	low
MTG	<i>Dactylis glomerata</i>	Cocksfoot	high	high
MTG	<i>Vulpia myuros</i>	Rat's-tail Fescue	high	low
MTG	<i>Bromus rubens</i>	Red Brome	high	low
MTG	<i>Avena barbata</i>	Bearded Oat	high	low
MTG	<i>Aira caryophyllea</i>	Silvery Hair-grass	high	low
SC	<i>Vicia sativa</i> ssp. <i>sativa</i>	Common Vetch	low	low

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Appendix 6. VVP Plains Grassy Woodland (EVC 55) Benchmark

Description:

An open, eucalypt woodland to 15 m tall. Occupies poorly drained, fertile soils on flat or gently undulating plains at low elevations. The understorey consists of a few sparse shrubs over a species-rich grassy and herbaceous ground layer. This variant occupies areas receiving approximately 500 – 700 mm annual rainfall.

Large trees:

Species	DBH(cm)	#/ha
<i>Eucalyptus</i> spp.	80 cm	8 / ha

Tree Canopy Cover:

%cover	Character Species	Common Name
10%	<i>Eucalyptus camaldulensis</i>	River Red Gum

Understorey:

Life form	#Spp	%Cover	LF code
Immature Canopy Tree		5%	IT
Understorey Tree or Large Shrub	1	5%	T
Medium Shrub	3	10%	MS
Small Shrub	2	1%	SS
Prostrate Shrub	1	1%	PS
Large Herb	3	5%	LH
Medium Herb	8	15%	MH
Small or Prostrate Herb	3	5%	SH
Large Tufted Graminoid	2	5%	LTG
Medium to Small Tufted Graminoid	12	45%	MTG
Medium to Tiny Non-tufted Graminoid	2	5%	MNG
Bryophytes/Lichens	na	10%	BL
Soil Crust	na	10%	S/C

LF Code	Species typical of at least part of EVC range	Common Name
MS	<i>Acacia pycnantha</i>	Golden Wattle
MS	<i>Acacia paradoxa</i>	Hedge Wattle
SS	<i>Pimelea humilis</i>	Common Rice-flower
PS	<i>Astroloma humifusum</i>	Cranberry Heath
PS	<i>Bossiaea prostrata</i>	Creeping Bossiaea
MH	<i>Oxalis perennans</i>	Grassland Wood-sorrel
MH	<i>Gonocarpus tetragynus</i>	Common Raspwort
MH	<i>Acaena echinata</i>	Sheep's Burr
SH	<i>Dichondra repens</i>	Kidney-weed
SH	<i>Hydrocotyle laxiflora</i>	Stinking Pennywort
LTG	<i>Austrostipa mollis</i>	Supple Spear-grass
LTG	<i>Austrostipa bigeniculata</i>	Kneed Spear-grass
MTG	<i>Themeda triandra</i>	Kangaroo Grass
MTG	<i>Elymus scaber</i> var. <i>scaber</i>	Common Wheat-grass
MTG	<i>Austrodanthonia setacea</i>	Bristly Wallaby-grass
MTG	<i>Austrodanthonia racemosa</i> var. <i>racemosa</i>	Stiped Wallaby-grass
MNG	<i>Microlaena stipoides</i> var. <i>stipoides</i>	Weeping Grass

Recruitment:

Continuous

Organic Litter:

10 % cover

Logs:

10 m/0.1 ha.

Weediness:

LF Code	Typical Weed Species	Common Name	Invasive	Impact
MS	<i>Lycium ferocissimum</i>	African Box-thorn	high	high
LH	<i>Cirsium vulgare</i>	Spear Thistle	high	high
LH	<i>Sonchus oleraceus</i>	Common Sow-thistle	high	low
LH	<i>Plantago lanceolata</i>	Ribwort	high	low
MH	<i>Hypochoeris radicata</i>	Cat's Ear	high	low
LNG	<i>Holcus lanatus</i>	Yorkshire Fog	high	high

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MTG	<i>Vulpia bromoides</i>	Squirrel-tail Fescue	high	low
MTG	<i>Romulea rosea</i>	Onion Grass	high	low
MTG	<i>Briza minor</i>	Lesser Quaking-grass	high	low
MTG	<i>Briza maxima</i>	Large Quaking-grass	high	low

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Appendix 7. VVP Floodplain Riparian Woodland (EVC 56) Benchmark

Description:

An open eucalypt woodland to 20 m tall over a medium to tall shrub layer with a ground layer consisting of amphibious and aquatic herbs and sedges. Occurs along the banks and floodplains of the larger meandering rivers and major creeks, often in conjunction with one or more floodplain wetland communities. Elevation and rainfall are relatively low and soils are fertile alluviums subject to periodic flooding and inundation.

Large trees:

Species	DBH(cm)	#/ha
<i>Eucalyptus</i> spp.	80 cm	15 / ha

Tree Canopy Cover:

%cover	Character Species	Common Name
20%	<i>Eucalyptus camaldulensis</i>	River Red-gum
	<i>Eucalyptus ovata</i>	Swamp Gum

Life Forms:

Life form	#Spp	%Cover	LF code
Immature Canopy Tree		5%	IT
Understorey Tree or Large Shrub	1	5%	T
Medium Shrub	3	15%	MS
Large Herb	2	5%	LH
Medium Herb	4	10%	MH
Small or Prostrate Herb	3	10%	SH
Large Tufted Graminoid	3	15%	LTG
Large Non-tufted Graminoid	1	10%	LNG
Medium to Small Tufted Graminoid	5	15%	MTG
Medium to Tiny Non-tufted Graminoid	3	10%	MNG
Scrambler or Climber	1	5%	SC
Bryophytes/Lichens	na	10%	BL

LF Code	Species typical of at least part of EVC range	Common Name
T	<i>Acacia melanoxylon</i>	Blackwood
MS	<i>Bursaria spinosa</i> ssp. <i>spinosa</i>	Sweet Bursaria
MS	<i>Acacia pycnantha</i>	Golden Wattle
MS	<i>Myoporum</i> sp. 1	Sticky Boobiolla
LH	<i>Senecio glomeratus</i>	Annual Fireweed
MH	<i>Rumex brownii</i>	Slender Dock
SH	<i>Dichondra repens</i>	Kidney-weed
SH	<i>Crassula helmsii</i>	Swamp Crassula
SH	<i>Selliera radicans</i>	Shiny Swamp-mat
SH	<i>Hydrocotyle sibthorpioides</i>	Shining Pennywort
LTG	<i>Lomandra longifolia</i>	Spiny-headed Mat-rush
LTG	<i>Gahnia filum</i>	Chaffy Saw-sedge
LTG	<i>Poa labillardierei</i>	Common Tussock-grass
LTG	<i>Juncus kraussii</i> ssp. <i>australiensis</i>	Sea Rush
LNG	<i>Phragmites australis</i>	Common Reed
MTG	<i>Lachnagrostis filiformis</i>	Common Blown-grass
MTG	<i>Austrodanthonia penicillata</i>	Slender Wallaby-grass
MTG	<i>Dianella revoluta</i> s.l.	Black-anther Flax-lily
MTG	<i>Bulbine bulbosa</i>	Bulbine Lily
MNG	<i>Triglochin striatum</i>	Streaked Arrowgrass
MNG	<i>Schoenus nitens</i>	Shiny Bog-sedge
MNG	<i>Distichlis distichophylla</i>	Australian Salt-grass
EP	<i>Muellerina eucalyptoides</i>	Creeping Mistletoe
SC	<i>Cassytha melantha</i>	Coarse Dodder-laurel
SC	<i>Calystegia sepium</i>	Large Bindweed

Recruitment:

Episodic/Flood. Desirable period between disturbances is 5 years.

Organic Litter:

40 % cover

Logs:

30 m/0.1 ha.

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Weediness:

LF Code	Typical Weed Species	Common Name	Invasive	Impact
MS	<i>Rosa rubiginosa</i>	Sweet Briar	high	high
LH	<i>Rumex conglomeratus</i>	Clustered Dock	high	high
LH	<i>Sonchus oleraceus</i>	Common Sow-thistle	high	low
LH	<i>Rumex crispus</i>	Curled Dock	high	high
LH	<i>Helminthotheca echioides</i>	Ox-tongue	high	low
LH	<i>Aster subulatus</i>	Aster-weed	high	low
LH	<i>Cirsium vulgare</i>	Spear Thistle	high	high
LH	<i>Sonchus asper s.l.</i>	Rough Sow-thistle	high	low
LH	<i>Plantago lanceolata</i>	Ribwort	high	low
MH	<i>Hypochoeris radicata</i>	Cat's Ear	high	low
MH	<i>Plantago major</i>	Greater Plantain	high	low
MH	<i>Brassica fruticulosa</i>	Twiggy Turnip	high	high
MH	<i>Atriplex prostrata</i>	Hastate Orache	high	high
LTG	<i>Phalaris aquatica</i>	Toowoomba Canary-grass	high	high
LNG	<i>Holcus lanatus</i>	Yorkshire Fog	high	high
MTG	<i>Cyperus eragrostis</i>	Drain Flat-sedge	high	high
MTG	<i>Bromus catharticus</i>	Prairie Grass	high	low
MTG	<i>Lolium perenne</i>	Perennial Rye-grass	high	high
MNG	<i>Paspalum distichum</i>	Water Couch	high	high

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Appendix 8. VVP Aquatic Herbland (EVC 653) Benchmark

Description:

Herbland of permanent to semi-permanent wetlands, dominated by sedges (especially on shallower verges) and/or aquatic herbs. Occurs on fertile paludal soils, typically heavy clays beneath organic accumulations.

Life Forms:

Life form	#Spp	%Cover	LF code
Medium Shrub	1	1%	MS
Small Shrub	1	1%	SS
Large Herb	2	10%	LH
Medium Herb	5	40%	MH
Small or Prostrate Herb	2	10%	SH
Large Non-tufted Graminoid	1	5%	LNG
Medium to Small Tufted Graminoid	4	10%	MTG
Medium to Tiny Non-tufted Graminoid	2	10%	MNG
Total understorey projective foliage cover		85%	

LF Code	Species typical of at least part of EVC range	Common Name
LH	<i>Villarsia reniformis</i>	Running Marsh-flower
MH	<i>Myriophyllum simulans</i>	Amphibious Water-milfoil
MH	<i>Potamogeton tricarinatus s.l.</i>	Floating Pondweed
MH	<i>Potamogeton pectinatus</i>	Fennel Pondweed
MH	<i>Marsilea drummondii</i>	Common Nardoo
SH	<i>Azolla filiculoides</i>	Pacific Azolla
SH	<i>Lobelia pratioides</i>	Poison Lobelia
SH	<i>Lemna disperma</i>	Duckweed
LNG	<i>Eleocharis sphacelata</i>	Tall Spike-sedge
MTG	<i>Triglochin procerum s.l.</i>	Water Ribbons
MTG	<i>Lachnagrostis filiformis</i>	Common Blown-grass
MTG	<i>Glyceria australis</i>	Australian Sweet-grass
MTG	<i>Austrodanthonia duttoniana</i>	Brown-back Wallaby-grass
MNG	<i>Eleocharis pusilla</i>	Small Spike-sedge
MNG	<i>Eleocharis acuta</i>	Common Spike-sedge

Recruitment:

Episodic/Flood. Desirable period between disturbances is 5 years.

Organic Litter:

10% cover

Weediness:

LF Code	Typical Weed Species	Common Name	Invasive	Impact
LH	<i>Aster subulatus</i>	Aster-weed	high	low
LH	<i>Rumex crispus</i>	Curled Dock	high	low
MH	<i>Plantago coronopus</i>	Buck's-horn Plantain	high	high
MH	<i>Cotula coronopifolia</i>	Water Buttons	high	high
MTG	<i>Lolium rigidum</i>	Wimmera Rye-grass	high	low
MTG	<i>Romulea rosea</i>	Onion Grass	high	low

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Appendix 9. VVP Escarpment Shrubland (EVC 895) Benchmark

Description:

Occurs on rocky escarpments in steep valleys or gorges, associated with limestone or basalt. Sites have moderate to high fertility, are well-drained but subject to regular summer drought due to shallow soils. Eucalypt woodland to 15 m tall or non-eucalypt shrubland to 8 m tall, with occasional eucalypts; lichen-covered rock outcrops are common.

+ eucalypt woodland only components (ignore when assessing shrubland areas and standardise site condition score as required)

Large trees⁺:

Species	DBH(cm)	#/ha
<i>Eucalyptus</i> spp.	70 cm	15 / ha

Tree Canopy Cover:

%cover	Character Species	Common Name
15%	<i>Acacia implexa</i>	Lightwood
	<i>Allocasuarina verticillata</i>	Drooping Sheoak
	<i>Acacia mearnsii</i>	Black Wattle
	<i>Bursaria spinosa</i>	Sweet Bursaria
	<i>Eucalyptus viminalis</i> ssp. <i>viminalis</i>	Manna Gum

Understorey:

Life form	#Spp	%Cover	LF code
Immature Canopy Tree ⁺		5%	IT
Understorey Tree or Large Shrub ⁺	3	10%	T
Medium Shrub	3	10%	MS
Small Shrub	2	5%	SS
Large Herb	3	5%	LH
Medium Herb	4	10%	MH
Small or Prostrate Herb	5	5%	SH
Large Tufted Graminoid	1	5%	LTG
Large Non-tufted Graminoid	1	5%	LNG
Medium to Small Tufted Graminoid	9	25%	MTG
Medium to Tiny Non-tufted Graminoid	3	5%	MNG
Ground Fern	1	5%	GF
Scrambler or Climber	1	5%	SC
Bryophytes/Lichens	na	10%	BL
Soil Crust	na	10%	S/C

LF Code	Species typical of at least part of EVC range	Common Name
MS	<i>Rhagodia parabolica</i>	Fragrant Saltbush
MS	<i>Hymenanthera dentata</i> s.l.	Tree Violet
SS	<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	Ruby Saltbush
LH	<i>Wahlenbergia communis</i> s.l.	Tufted Bluebell
MH	<i>Oxalis perennans</i>	Grassland Wood-sorrel
MH	<i>Maireana enchylaenoides</i>	Wingless Bluebush
MH	<i>Einadia nutans</i> ssp. <i>nutans</i>	Nodding Saltbush
SH	<i>Chamaesyce drummondii</i>	Flat Spurge
SH	<i>Dichondra repens</i>	Kidney-weed
LTG	<i>Austrostipa bigeniculata</i>	Kneed Spear-grass
MTG	<i>Austrodanthonia racemosa</i> var. <i>racemosa</i>	Striped Wallaby-grass
MTG	<i>Austrodanthonia setacea</i>	Bristly Wallaby-grass
MNG	<i>Panicum effusum</i>	Hairy Panic
GF	<i>Cheilanthes distans</i>	Bristly Cloak-fern
SC	<i>Clematis microphylla</i>	Small-leaved Clematis
SC	<i>Convolvulus erubescens</i> spp. agg.	Pink Bindweed

Recruitment:

Continuous

Organic Litter:

20 % cover

Logs:

15 m/0.1 ha⁺.

5 m/0.1 ha. (note: large log class does not apply)

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Weediness:

LF Code	Typical Weed Species	Common Name	Invasive	Impact
T	<i>Schinus molle</i>	Pepper Tree	high	high
MS	<i>Lycium ferocissimum</i>	African Box-thorn	high	high
MS	<i>Genista monspessulana</i>	Montpellier Broom	high	high
SS	<i>Marrubium vulgare</i>	Horehound	high	high
LH	<i>Sonchus oleraceus</i>	Common Sow-thistle	high	low
LH	<i>Helminthotheca echioides</i>	Ox-tongue	high	high
LH	<i>Lactuca serriola</i>	Prickly Lettuce	high	low
LH	<i>Sisymbrium officinale</i>	Hedge Mustard	high	high
LH	<i>Sonchus asper</i> s.l.	Rough Sow-thistle	high	low
LH	<i>Verbascum thapsus</i> ssp. <i>thapsus</i>	Great Mullein	high	high
LH	<i>Echium plantagineum</i>	Paterson's Curse	high	high
LH	<i>Centaureum tenuiflorum</i>	Slender Centaury	high	low
LH	<i>Foeniculum vulgare</i>	Fennel	high	high
MH	<i>Hypochoeris radicata</i>	Cat's Ear	high	low
MH	<i>Trifolium arvense</i> var. <i>arvense</i>	Hare's-foot Clover	high	low
MH	<i>Trifolium subterraneum</i>	Subterranean Clover	high	low
MH	<i>Trifolium campestre</i> var. <i>campestre</i>	Hop Clover	high	low
MH	<i>Trifolium angustifolium</i> var. <i>angustifolium</i>	Narrow-leaf Clover	high	low
MH	<i>Lotus suaveolens</i>	Hairy Bird's-foot Trefoil	high	low
MH	<i>Cerastium glomeratum</i> s.l.	Common Mouse-ear Chickweed	high	low
SH	<i>Medicago polymorpha</i>	Burr Medic	high	low
SH	<i>Trifolium glomeratum</i>	Cluster Clover	high	low
SH	<i>Modiola caroliniana</i>	Red-flower Mallow	high	low
SH	<i>Aptenia cordifolia</i>	Heart-leaf Ice-plant	high	high
LTG	<i>Phalaris aquatica</i>	Toowoomba Canary-grass	high	high
LNG	<i>Holcus lanatus</i>	Yorkshire Fog	high	high
LNG	<i>Avena fatua</i>	Wild Oat	high	low
MTG	<i>Nassella trichotoma</i>	Serrated Tussock	high	high
MTG	<i>Ehrharta longiflora</i>	Annual Veldt-grass	high	low
MTG	<i>Briza maxima</i>	Large Quaking-grass	high	low
MTG	<i>Bromus hordeaceus</i> ssp. <i>hordeaceus</i>	Soft Brome	high	low
MTG	<i>Sporobolus africanus</i>	Rat-tail Grass	high	high
MTG	<i>Vulpia bromoides</i>	Squirrel-tail Fescue	high	low
MTG	<i>Romulea rosea</i>	Onion Grass	high	low
MTG	<i>Pentaschistis airoides</i> ssp. <i>airoides</i>	False Hair-grass	high	low
MTG	<i>Lolium perenne</i>	Perennial Rye-grass	high	high
MTG	<i>Dactylis glomerata</i>	Cocksfoot	high	high
MTG	<i>Vulpia myuros</i>	Rat's-tail Fescue	high	low
MTG	<i>Bromus rubens</i>	Red Brome	high	low
MTG	<i>Avena barbata</i>	Bearded Oat	high	low
MTG	<i>Aira caryophyllea</i>	Silvery Hair-grass	high	low
SC	<i>Vicia sativa</i> ssp. <i>sativa</i>	Common Vetch	high	low

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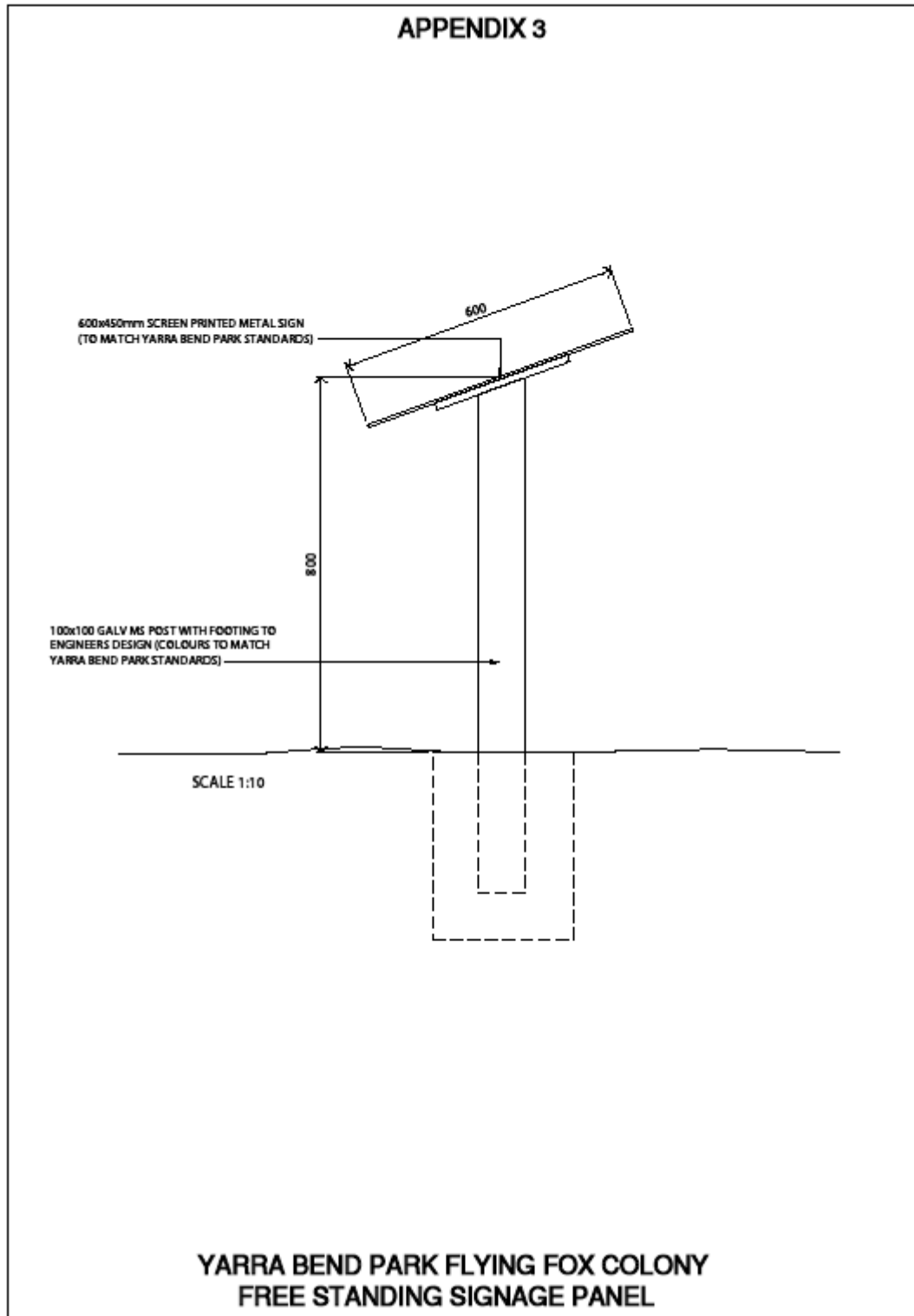
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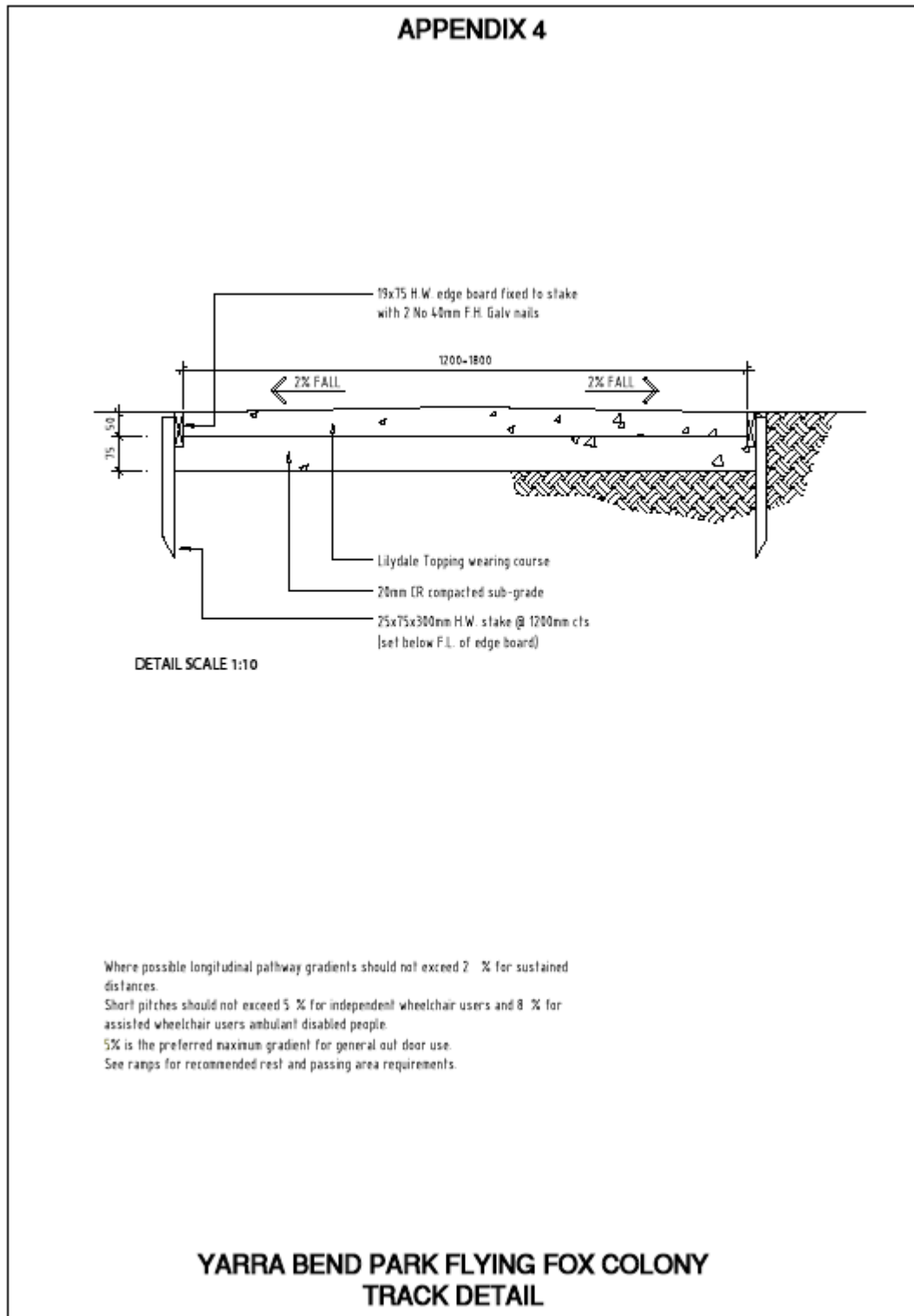
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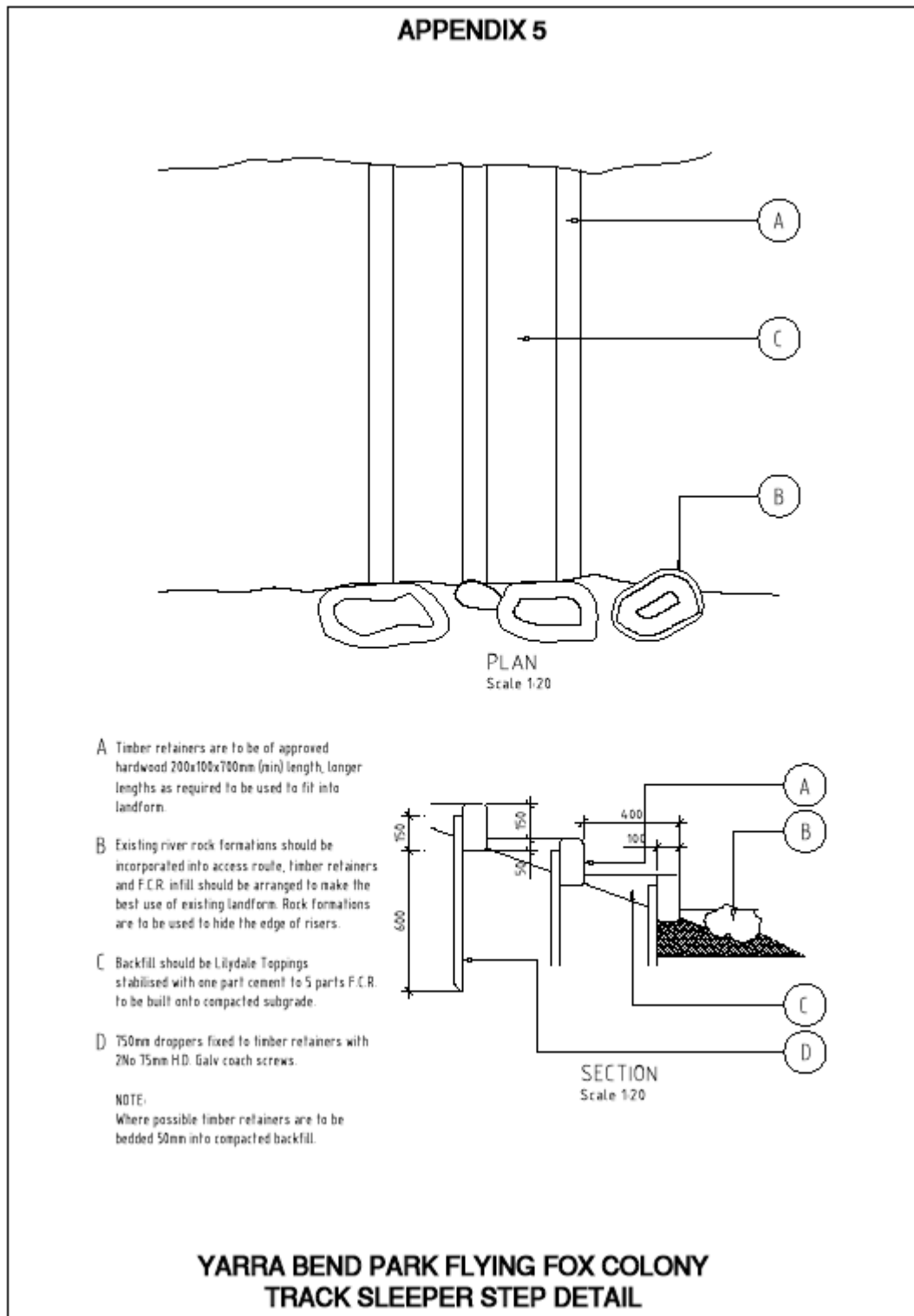
Appendix 3: Signage specifications



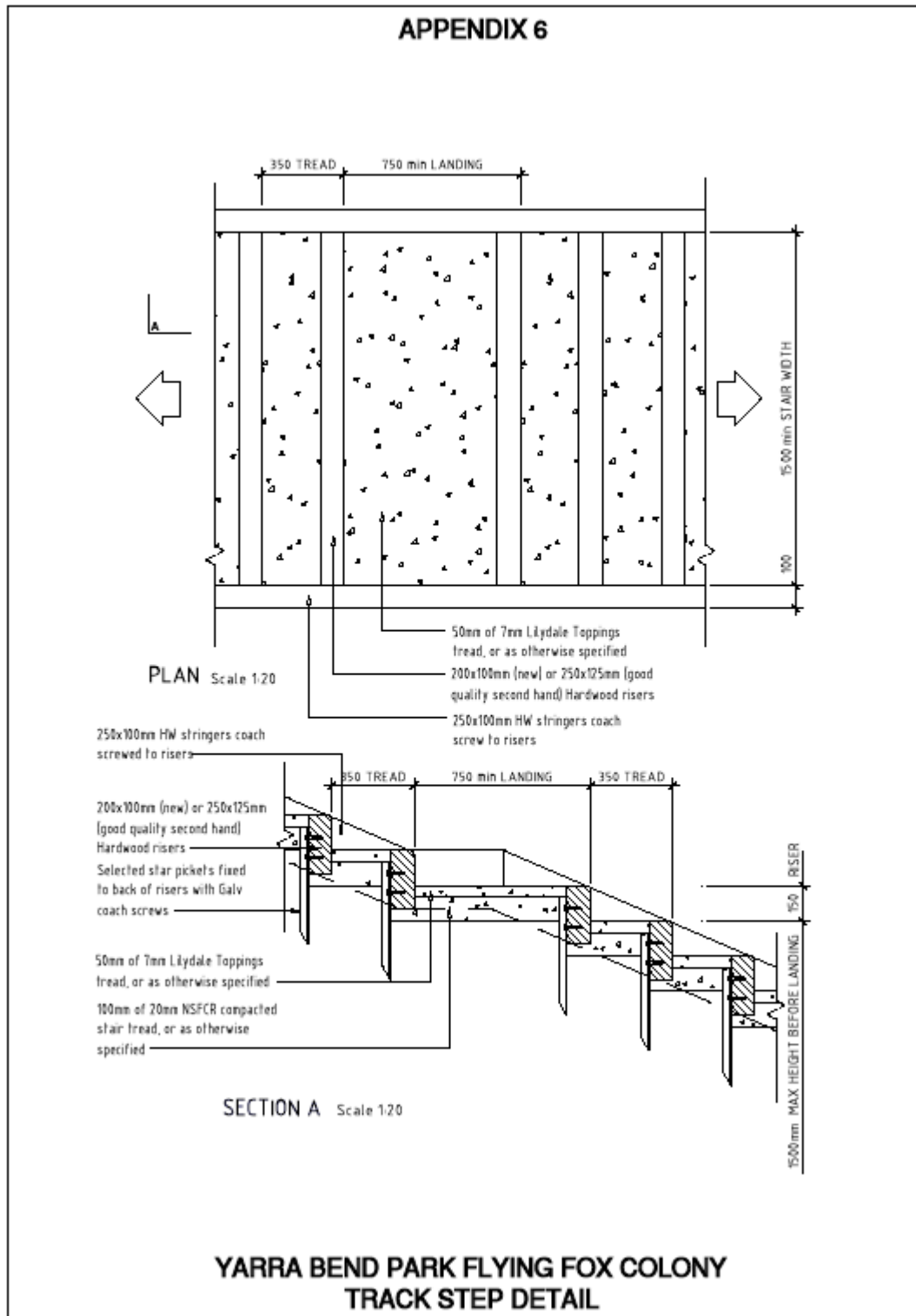
Appendix 4: Track detail



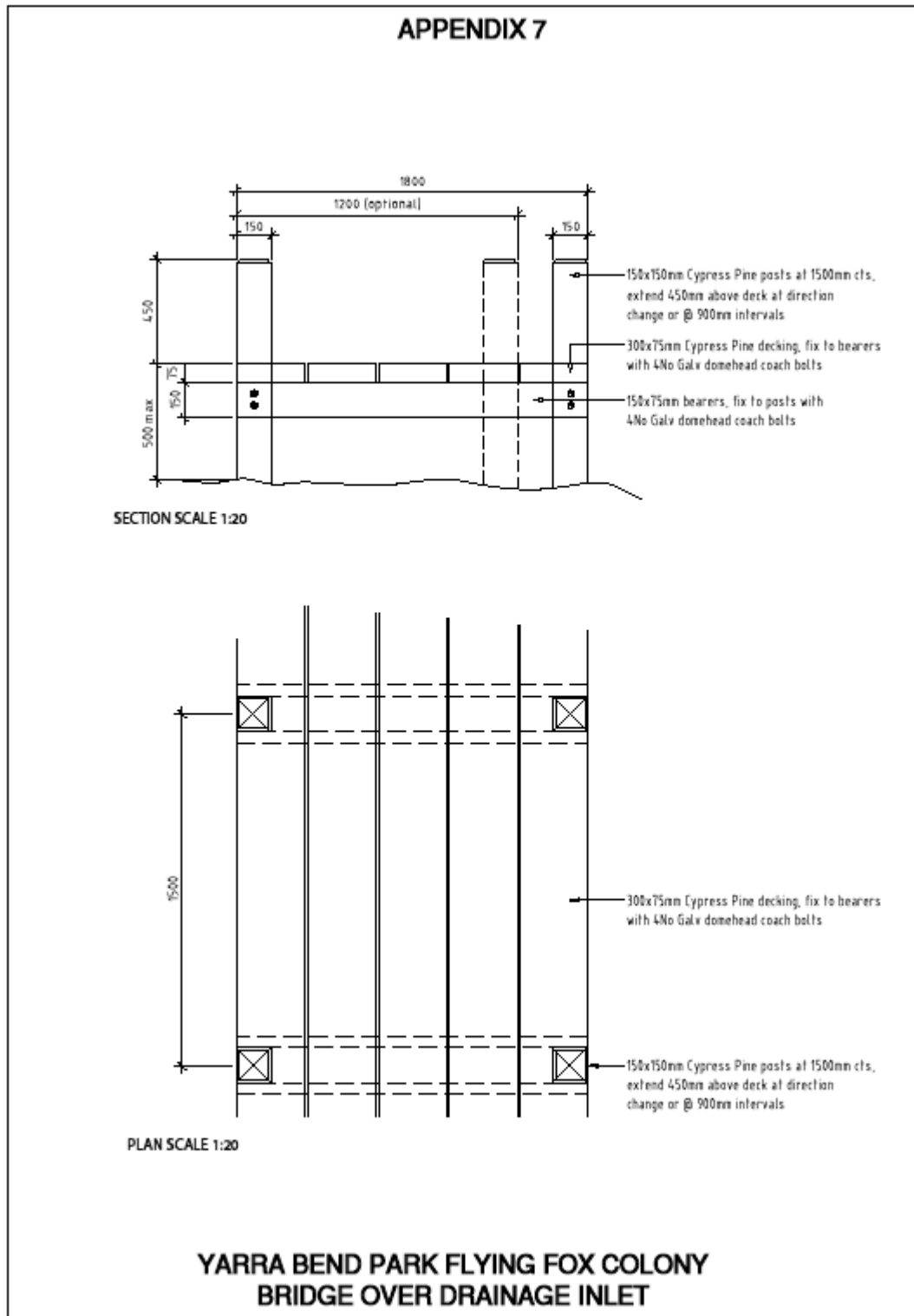
Appendix 5: Sleeper step detail



Appendix 6: Step detail



Appendix 7: Bridge detail



Appendix 8: Viewing deck detail

