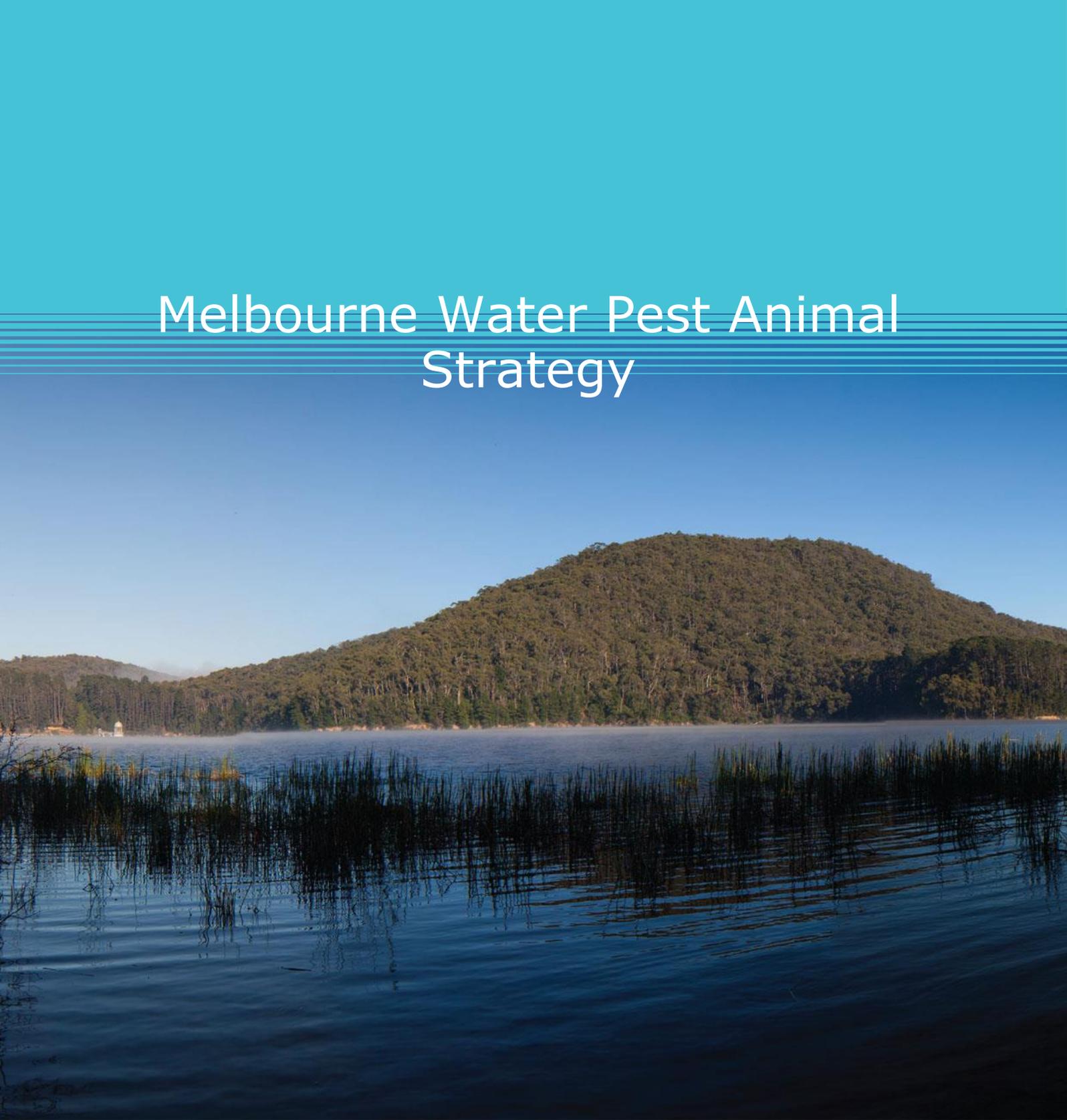


Melbourne Water Pest Animal Strategy



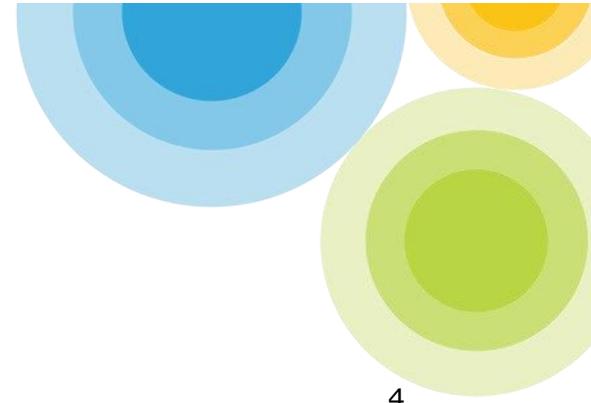


Table of contents

Executive Summary	4
Introduction	4
Pest Animal Strategy Aim	5
Pest Animal Strategy Objectives	5
Background	5
Melbourne Water’s Land	5
Assets	6
Natural Assets	6
Physical Assets.....	6
Public Health	6
Other Key Documents	7
Figure 1 Melbourne Water’s Strategic Policy Framework	8
Linkages between Pest Animal Management Documents	8
Pest Animal Management Obligations	9
History of Pest Animals	9
Impacts	9
Legislative Obligations	10
Pest Animal - Definitions	11
Definition	11
Pest Animal Species.....	11
Other Perceived Pest Animals.....	12
Pest Animal Ecology.....	12
Melbourne Water’s Pest Animal Management	13
Historical Pest Animal Management.....	13
Current Status	14
Priority Sites for Pest Animal Management	15
Natural Assets	15
Physical Assets.....	16
Public Health	16
Strategy for Pest Animal Management	16
Vision and Objectives for Pest Animal Management	16
Pest Animal Management Cycle	17
Data Collection.....	17
Consultation, Research and Education	18
Implementation	19

Monitoring	20
References	21
Appendix A: Criteria, Rationale, Measure and Limitations for Selection of sites	23
Appendix B: Summary of Consulted Key Stakeholders	27

Executive Summary

The Australian Pest Animal Strategy (APAS, 2007) defines pest animals 'as any animal that has, or has the potential to have an adverse economic, environmental or social/cultural impact.' This Pest Animal Strategy presents Melbourne Water's strategic approach to the management of pest animals for areas that Melbourne Water manages. It outlines the pest animal management vision (consistent with Melbourne Water's Strategic Framework) and provides a set of considerations and actions to enable the strategic and targeted management of pest animals. Melbourne Water's vision for pest animal management is:

The targeted reduction in pest animal impacts will protect Melbourne Water's environmental, financial and social values, and it's capability to safeguard successful outcomes for its activities.

Pest animal management programs have been completed over many years at a number of Melbourne Water sites. A strategic, best-practice approach to pest animal management across Melbourne Water's land is required, aligned with relevant National and State policies, to ensure resources are used in a wise and prioritised manner.

Pest animal management on Melbourne Water land will operate on three levels.

1. This **Pest Animal Strategy** provides the framework and the targeted selection for pest animal management.
2. The **Pest Animal Guidelines** provide the technical reference for pest animal management and aligns with this Strategy.
3. **Local Pest Animal Action Plans** are site-specific management plans for Pest Animal Management; they must be implemented according to the Pest Animal Guidelines and developed for selected 'priority sites'.

Effective pest animal management requires the strategic, targeted and consistent allocation of resources to manage pest animals.

This Strategy has adopted a five-step, cyclical 'Pest Animal Management Action Cycle' to achieve the Strategy's vision. Strategy actions have been identified using this Action Cycle to address Data Collection, Consultation, Research & Education, Implementation, Monitoring and Review, which will improve future pest animal management. The Strategy's success will be measured against each action's performance indicator.

Introduction

Managing the impacts of pest animals is a key component in the sustainable and effective management of land and natural resources. As a large landholder with many stakeholders and various natural and built assets, Melbourne Water has multiple areas of responsibility regarding the management of pest animals. These responsibilities include complying with relevant Commonwealth and State government legislation, ensuring the protection of water quality, protecting and enhancing natural as well as built environments and addressing community and stakeholder expectations and concerns.

Pest animal management is undertaken to participate in external pest animal programs and/or to protect multiple organisational values, including:

- Natural assets
- Physical assets
- Water quality
- Waterways

The pest animals and aims of management differ between Melbourne Water site locations, and should be determined according to local on-site value requirements.

To date, pest animal management by Melbourne Water has consisted of a range of responses and actions to real or perceived threats to financial, environmental or social values and has often been conducted in a responsive manner, consequently, the effectiveness of pest animal management programs to date have been variable.

Given the uncertainty surrounding the effectiveness of past pest animal management, this strategy serves as a best-practice approach to pest animal management across land managed by Melbourne Water, which aligns with relevant National and State policies and documents

This document was guided by a review of relevant literature and consultation with stakeholders involved with pest animal management throughout the Port Phillip and Westernport region (see Appendix B). Consultation provided information and feedback on pest animal management in the region and the various issues associated with pest control.

Pest Animal Strategy Aim

This Pest Animal Strategy (the Strategy) has been developed to provide guidance and a framework for pest animal management by Melbourne Water. This will ensure pest animal management is targeted, effective and supports stakeholders and the wider community.

Pest Animal Strategy Objectives

The Strategy has been developed to provide the following:

- An overarching framework for pest animal management on land managed by Melbourne Water
- Identification of a Hierarchy for Pest Animal Management (see Table 2)
- Identification of organisation wide actions to improve pest animal management on Melbourne Water managed sites.

Background

Melbourne Water's Land

Melbourne Water is a significant landholder in the Port Phillip and Westernport region, managing approximately 33,000 hectares of land and over 8,000 kilometres of

waterways. This represents around 2.5% of the land contained within the Port Phillip and Westernport region. Types of land managed by Melbourne Water include reservoirs, treatment plants, aqueducts/pipe tracks, waterways, natural and constructed wetlands, and biodiversity reference areas. In addition to directly managed land, Melbourne Water has a substantial stake in National and State Parks that include the water supply catchment areas, which are important for collecting the majority of Melbourne's drinking water.

Assets

Melbourne Water's land supports a number of key physical and natural assets incorporating environmental, financial and social values.

Natural Assets

Melbourne Water manages a number of important natural assets including waterways and wetlands, native vegetation and a number of rare and threatened species.

These natural assets provide water for consumption, stormwater filtration, contribute to environmental values, have strong cultural and historical associations and are a focal point for recreation and tourism. There are several high value wetland systems, including the Western Treatment Plant and the Edithvale-Seaford Wetlands, which are listed under the International Ramsar Convention. These and many other wetlands not only provide important ecosystems and water cycling services, but also support habitat for numerous internationally protected migratory bird species (W. Steele, pers. comm. 2009).

Native vegetation is an important natural asset that has largely been cleared or modified in the state of Victoria. Land managed by Melbourne Water includes numerous areas of native vegetation of varying quality, including large remnant patches surrounding physical assets. As well as its intrinsic and amenity values, this native vegetation provides habitat for many native species, including National and State listed threatened species and communities.

Maintaining the health and productivity of these natural assets is vital for the triple bottom line of environmental sustainability, long term financial growth and social wellbeing (Gibson and West, 2006; IACRC, 2007).

Physical Assets

Melbourne Water manages a number of important physical assets (infrastructure), including pumping and transfer stations, treatment plants, pipes, constructed water bodies and aqueducts.

These physical assets assist Melbourne Water to carry out its responsibilities in regards to water supply and transfer, sewage treatment, flood protection and drainage. The protection and maintenance of these assets is essential and is therefore a primary focus for Melbourne Water.

Public Health

Melbourne Water has a core responsibility to protect public health. Public health could be compromised by pest animals through impacts to water quality (e.g. faecal

contamination in closed catchments and animal carcasses in open aqueducts) and sewage treatment (e.g. sewage spills into the environment).

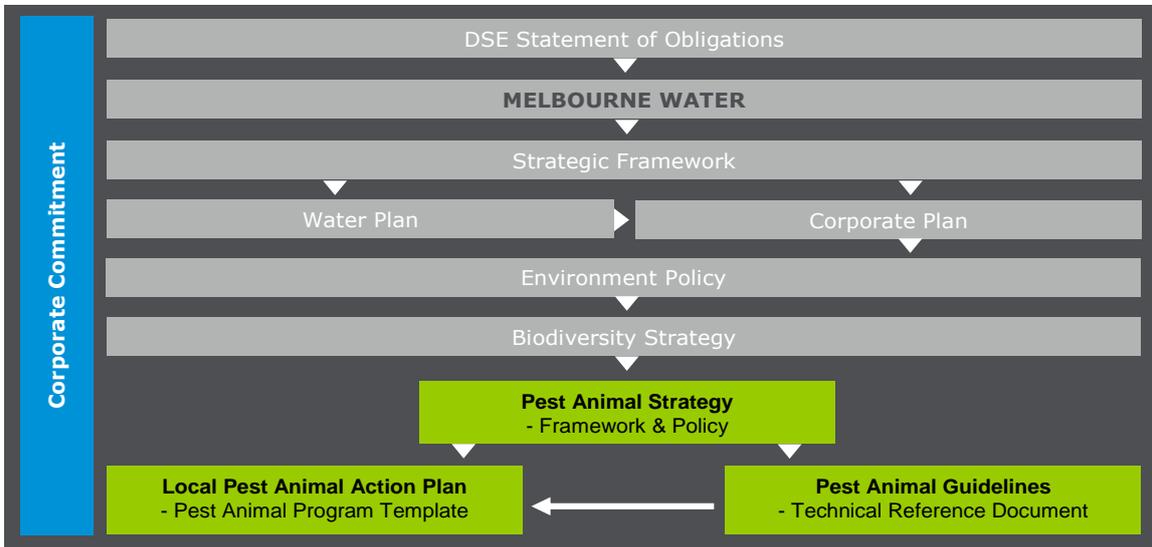
Other Key Documents

The Strategy is consistent with the following National and State strategic documents:

- The Australian Pest Animal Strategy (NRMMC, 2007) is the National strategy for the management of vertebrate pest animals in Australia
- The Biosecurity Strategy for Victoria (DPI, 2009) covers threats to financial, environmental and social values across public and private land in Victoria, including plant and animal pests and diseases, and invasive plants and animals
- The draft Invasive Plants and Animals Policy Framework (DPI, 2009) provides guidance for future policy, planning and activities specific to invasive plants and animals in Victoria, and operates within the directions set out in the Biosecurity Strategy for Victoria.
- The Victorian Pest Management – A Framework for Action (DNRE, 2002) provides the strategic direction for managing declared and potential pests, and includes specific management strategies for rabbits, wild dogs, foxes, pigs and goats
- The National Threat Abatement Plans (DEWHA, 2009) establish a national framework to coordinate the response to key threatening processes registered under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Threat Abatement Plans considered in this Strategy include those for goats (2008), rabbits (2008), foxes (2008), cats (2008) and pigs (2005)
- The Port Phillip and Westernport Rabbit Action Plan (PPWCMA, 2003) outlines the responsibilities of land managers within the region for rabbit control and prioritises the allocation of resources for rabbit management programs.

Melbourne Water has a number of internal and external regulations, policies, and strategies to assist the business to achieve biodiversity management excellence (see Figure 1). This Pest Animal Strategy is part of a hierarchy, encapsulating Melbourne Water's Statement of Obligations requirement of "maintaining and restoring natural assets".

Figure 1 Melbourne Water’s Strategic Policy Framework



Linkages between Pest Animal Management Documents

Pest animal management by Melbourne Water is guided amongst three tiers:

1. Pest Animal Strategy
2. Pest Animal Guidelines (2009)
3. Local Pest Animal Action Plans (LPAAPs).

The Pest Animal Strategy - informs the need for pest animal management, identifies a Pest Animal Management Hierarchy and provides the basis for selecting sites it is applicable for through the identification of values and threats. The Strategy also covers pest animal management issues that must be considered prior to management operations commencing.

The Pest Animal Guidelines - are the technical reference document for pest animal management and include detailed information on pest species, conventional and innovative control techniques, legislative requirements, monitoring considerations and contractor requirements. The Guidelines are a key resource for Melbourne Water staff and stakeholders in developing LPAAPs, and for staff and contractors involved in on-ground operations.

Local Pest Animal Action Plan - Template is a site-specific plan that outlines management actions for pest species. They provide the specific details of pest animal management at a site, including the timeframe, budget, stakeholder collaboration and the monitoring protocol. The LPAAP (2009) outlines the process and considerations for preparing an LPAAP, and provides a template for developing these plans.

Pest Animal Management Obligations

History of Pest Animals

Following the European settlement of Victoria, many exotic animals were introduced either to increase the resemblance of the land to England, or to provide supposed benefits through the provision of food, sporting opportunities or ironically enough, to control 'pests'. Since European settlement hundreds of exotic vertebrates have been introduced across Australia, many of them repeatedly (Olsen, 1998). While many of these species failed to establish in the wild, many others were highly successful, and are now considered to be major agricultural or environmental pests (IACRC, 2007).

One of the most successful pest species in Australia was the European Rabbit (*Oryctolagus cuniculus*), thought to have been successfully introduced onto the mainland around 1859 (Williams et al. 1995). The rapid expansion of this species may have facilitated the spread of various subsequently-introduced predators, especially the European Red Fox (*Vulpes vulpes*) and the Feral Cat (*Felis catus*), for which the rabbit represents a substantial prey item (Williams et al. 1995; Saunders and McLeod, 2007).

The ability of introduced species to rapidly increase their distribution and abundance, and particularly their potential impact upon human activities, was recognised quickly for many species. Rabbit control programs began around the 1870s and were widespread by the 1880s, fox control by 1893, and pig control by the 1880s (Saunders et al. 1995; Williams et al. 1995; Choquenot et al. 1996). However, introductions of various exotic animals continued, at varying rates, largely through deliberate introductions by societies and individuals, or through accidental escapes from farms (Olsen, 1998).

By the early 1900s, rabbits and foxes had spread throughout much of southeast Australia, and are now widespread throughout all but the tropical north of the continent (Olsen, 1998; IACRC, 2007). Cats were deliberately released on multiple occasions during the 1800s, largely in unsuccessful attempts to control rodents and rabbits, and their distribution increased to encompass the entire continent (IACRC, 2007). Other pest animals deliberately introduced in southeast Australia during the 1800s and early 1900s include dogs, pigs, goats and deer, as well as several bird species, many of which are currently distributed throughout most, or all of the State (IACRC, 2007).

Impacts

Introduced species are recognised globally as the second greatest threat (after habitat destruction) to biodiversity, primarily through competition, predation, habitat degradation and transmission of disease (Simberloff et al. 2005).

In Australia, pest animals are believed to be responsible for the extinction of many native vertebrates and the decline in distribution and/or abundance of many more, particularly ground-nesting birds, small to medium-sized mammals and some reptile species (Saunders and McLeod, 2007; Dexter and Murray, 2009; DPI, 2009). They are also known to impact native vegetation and habitat through browsing, grazing, bark-stripping, trampling and erosion (Williams et al. 1995; Hall and Gill 2005). These

effects can be particularly pronounced over time, with only those species unpalatable or resilient to the pest animal persisting.

Pest animals also have a significant impact on primary industries, including loss of productivity (quality and quantity), reduced land value and the direct cost of control and mitigation to land managers. The economic costs of six groups of pest animals (rabbits, foxes, dogs, pigs, birds and mice) on production and governments were recently conservatively estimated at over \$740 million annually Australia-wide (Gong et al. 2009). This figure is based on known expenditure and impacts and is therefore a minimum value, and it also does not include any environmental costs or impacts to infrastructure or communities.

Pest animals can also pose a direct risk to human health and welfare, through traffic collisions (e.g. deer) and direct attacks (e.g. wild dogs). Many pest species are also vectors for disease (e.g. foot-and-mouth, rabies) in humans, livestock and native fauna. Other social values negatively affected by pest animals include domestic pets, amenity values (e.g. recreation) and the aesthetic value of the landscape (White et al. 2008; T. Bloomfield, pers. comm. 2009).

There is also evidence that pest animals can impact water quality. These impacts can occur through increased erosion and turbidity, alteration of the biotic composition of aquatic habitats, and through the spread of pathogens such as *Cryptosporidium* spp. and *Giardia* spp. (Choquenot et al. 1996; A. Sneskov pers. comm., 2009).

The effects of climate change on the distribution and impact of pest animals also needs to be considered. Pest animals generally possess life history traits well-adapted to disturbance (Steffen et al. 2009). In addition, native species currently impacted by pest animals are likely to be the same species affected by climate change, because the characteristics that increase a species' risk from pest animals and from climate change overlap (Steffen et al. 2009). There is also potential for some introduced and native species not currently considered pests to expand their range or abundance to the extent that they substantially impact on natural or anthropogenic values.

Legislative Obligations

As a result of the greater awareness of the impacts of pest animals, many species are recognised as key threatening processes at both a National and State level, and the control of some pest species is now legislated.

The Victorian *Catchment and Land Protection Act 1994* (CaLP Act) establishes a basis for the control of declared pest plants and animals in Victoria. Foxes, rabbits, dogs, pigs, goats and hares are all recognised as established pest animals under the CaLP Act, which means that they are considered a serious threat to primary production, Crown land, the environment or community health. Landowners must prevent the spread and, as far as possible, eradicate these established pest animals (CaLP Act, 1994).

The impacts of several pest species are also recognised as threatening processes under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the Victorian *Flora and Fauna Guarantee Act 1988* (FFG Act). Threat abatement plans (Commonwealth) and action statements (Victoria) have been

developed for these processes which establish the framework and actions necessary to manage and mitigate each particular process.

Current evidence shows that the impacts of pest animals in ecosystems are often not static. Rather, in the absence of effective pest animal management, the impacts to environmental or financial values are likely to increase, often until the carrying capacity of the pest in the ecosystem is reached (e.g. Coutts-Smith, 2007; Saunders and McLeod, 2007). Furthermore, the stress imposed by pest animals upon natural values is compounded by the impacts of habitat loss and climate change etc. Without management intervention, many pest animals in the Port Phillip and Westernport region are likely to increase in both distribution and abundance, as they occupy vacant niches and/or further displace native species (e.g. Forsyth et al. 2004; Coutts-Smith 2007).

Given this trajectory for pest animals, continuing the current management practices is likely to result in ongoing and potentially increased impacts to environmental, financial and social values. However, a greater understanding of the threats posed by pest animals to these values provides the opportunity for the strategic and effective management of threats for Melbourne Water.

Pest Animal - Definitions

Definition

The Australian Pest Animal Strategy (APAS, 2007) defines pest animals '*as any animal that has, or has the potential to have, an adverse economic, environmental or social / cultural impact.*' This broad definition incorporates species that vary across spatial and temporal scales, and the term 'pest animal' in this Strategy refers to:

- Those species which have been declared in the Prohibited, Controlled, Regulated or Established pest animal categories under the CaLP Act
- Non CaLP-listed species known to have significant impacts upon environmental, financial or social values.

The focus of the Strategy is currently on introduced terrestrial vertebrate pest species as listed in Section 2.9, however, the principles and actions may be applied to other species, including overabundant native species. Future review of this Strategy may include other animal species such as overabundant natives, aquatic pests and invertebrate pests.

Pest Animal Species

Pest species considered to have, or to potentially have, significant impacts on environmental, financial and social values for Melbourne Water are listed below.

- European Rabbit (*Oryctolagus cuniculus*)
- European Red Fox (*Vulpes vulpes*)
- Feral Pig (*Sus scrofa*)

- Wild Dog (*Canis lupus*) (including wild dogs (*C. l. familiaris*) and hybrids, but excluding the Dingo (*C. l. dingo*), listed as Threatened under the *Flora and Fauna Guarantee Act 1988*)
- Feral Goat (*Capra hircus*)
- European Brown Hare (*Lepus europaeus*).

Species not listed under the CaLP Act but considered as pest animals due to their known environmental impact include:

- Feral Cat (*Felis catus*)
- Deer (*Cervidae spp.*) - various species.

This Strategy focuses on the eight target species identified above, all other species causing significant issues will be addressed on an 'as need' basis.

Note: Deer are not listed under the CaLP Act, but are currently managed by Melbourne Water. The impacts of deer and the need for their management were issues frequently raised during the stakeholder consultation process. Furthermore, several studies have recently highlighted the impacts of deer upon environmental and agricultural values (Hall and Gill, 2005; Dolman and Waber, 2008; Lindeman and Forsyth 2008).

Other Perceived Pest Animals

In addition to the species listed above, there are a number of fish, bird and insect species, which may be considered pest animals in all or part of the Port Phillip and Westernport region due to their impacts upon natural and human values, but are not addressed as a part of this Strategy, examples of these species are:

- European Carp (*Cyprinus carpio*)
- Mosquito Fish (*Gambusia holbrooki*)
- Starlings *Sturnus (vulgaris)*
- Indian Mynas (*Acridotheres tristis*)
- Feral Honeybee (*Apis mellifera*)
- European Wasp (*Vespula germanica*)

There are a number of native animals occurring on land managed by Melbourne Water, which also have the potential to be considered pests at particular times or in specific locations, due to increased abundance and subsequent impacts upon natural, agricultural and social values. These animals, such as the Eastern Grey Kangaroo (*Macropus giganteus*) and the Emu (*Dromaius novaehollandiae*), may intermittently be subjected to population control by government agencies; however, they are not considered in this initial Strategy.

Pest Animal Ecology

While the specific biology and ecology of a pest animal varies by species, and to a lesser extent can vary by population, there are a number of characteristics common to most successfully introduced species. They are likely to be non-migratory, originate in an area with similar climatic conditions and are generally more able to live

commensally with people, often benefiting from anthropogenic changes to the landscape (Olsen, 1998; Forsyth et al. 2004). Widespread pest animals are also likely to have 'generalist' life-history traits such as a non-specialised diet and shorter life spans (Olsen, 1998).

Perhaps the most important characteristic of pest animals is their inherent ability to rapidly increase in abundance under favourable conditions. This is possible through the high population growth rate of most pest animals, arising from a combination of factors including large litter size, multiple litters per year, rapid sexual maturation, low parental investment, and often the lack of an effective predator(s) for the introduced species (Olsen, 1998; Forsyth et al. 2004).

Rapid growth rate is a well-known trait for many pest animal species including cats, foxes and goats, but is perhaps best demonstrated by the rabbit. Under favourable conditions rabbits can breed through all months of the year resulting in up to six litters annually, with 4-5 or more young per litter. Rabbits become sexually mature at three to four months and live up to three or more years (Williams et al. 1995; Olsen, 1998). Therefore a population of 10 rabbits (including five females) remaining after a control program can, under favourable conditions, produce around 150 rabbits within one year, many of which would have also been able to breed within this period.

The rapid population growth rate of most pest animals has important implications for their effective management. Isolated control programs are unlikely to be effective where pest animals occur on adjacent or nearby land, as recolonisation will generally occur rapidly following the cessation of control efforts.

Melbourne Water's Pest Animal Management

Historical Pest Animal Management

Pest animal management by Melbourne Water has historically been undertaken in a reactionary 'as needs' manner. Control programs were often based on community or stakeholder sightings/feedback or participation through organised internal or government/community programs.

The level of threat is generally determined based on the magnitude of real or perceived impacts to water supply assets, the environment, and social and amenity values, including stakeholder expectations and community perception (A. Sneskov; W. Steele, pers. comm. 2009).

Melbourne Water pest animal management programs have previously focused on foxes, rabbits, wild dogs and feral cats. Feral pigs and wild goats are usually isolated cases and have been targeted based on sightings. The status, and need for control, of deer is currently being monitored.

The forested catchment areas are currently managed under a Catchment Management Agreement between Parks Victoria and Melbourne Water, which was first signed in 1995. This agreement states that controlling and managing pest animals in the catchment areas will be a joint effort, including funding.

The overall success of previous pest animal management programs has been based on the number of animals removed from the population (operational monitoring), with little monitoring of the values being impacted (performance monitoring). However, as the number of pest animals killed often does not directly relate to a reduction in impacts (Reddix et al. 2006; Saunders and McLeod, 2007), the effectiveness of individual control programs is not accurately evaluated. Therefore, estimating the success of pest animal management, in terms of reducing impacts, across Melbourne Water land is difficult to determine.

Current Status

The abundance and impacts of pest animals on Melbourne Water land varies spatially and temporally. Rabbits and foxes are generally widespread and common, with most pest animal management efforts targeted towards these two species (W. Steele; A. Snegov, pers. comm., 2009). Cats are thought to be widespread and locally common, however they are difficult to monitor, and accurate data on their abundance is limited. Deer and dogs are currently largely restricted to catchment and associated riparian areas; while pigs and goats are recorded infrequently. Table 1 outlines the general distribution and potential impacts of the pest species listed in Section 2.9.

Public health could be compromised by pest animals through impacts to water quality (e.g. faecal contamination in closed catchments and animal carcasses in open aqueducts) and sewage treatment (e.g. sewage spills into the environment). Areas where these impacts could take place are relatively well known.

Table 1 The General Distribution and Potential Impacts of Pest Animals on Melbourne Water Land

Pest Species	Distribution	Potential Impacts *
European Red Fox (<i>Vulpes vulpes</i>)	Widespread and common	Impacts to biodiversity values, primarily predation on mammals in the critical weight range (0.45 – 5 kg) and competition with native predators. Predation on livestock (i.e. lambs).
European Rabbit (<i>Oryctolagus cuniculus</i>)	Widespread and common across, especially on well-drained soils and in non-forested areas	Substantial grazing impacts to native vegetation and agriculture values, including prevention of regeneration. Competition for resources with livestock and native fauna. Potential damage to infrastructure through burrowing. Indirect impacts through increased fox and cat abundance.
Feral Cat (<i>Felis catus</i>)	Widespread and generally sparsely distributed	Impacts to biodiversity values, primarily predation on mammals and other native fauna, and competition with native predators. Potential vector for infectious diseases i.e. toxoplasmosis and sarcosporidiosis.
Feral Dog (<i>Canis lupus</i>)	Primarily in the catchments and the urban-agricultural interface, locally common	Predation on livestock and medium to large native fauna. Potential vector for infectious diseases of humans (i.e. rabies), livestock (i.e. hydatids) and pets (i.e. heartworm and parvovirus)

Pest Species	Distribution	Potential Impacts *
Feral Pig (<i>Sus scrofa</i>)	Isolated occurrences, generally in forested or riparian areas (e.g. reservoirs), which offer protection from control	Impacts to agricultural values through predation and grazing. Impacts to vegetation, habitat and water quality through browsing, rooting and erosion. Predation on native fauna. Potential vector for several diseases affecting humans and livestock.
Feral Goat (<i>Capra hircus</i>)	Isolated occurrences, generally in forested or riparian areas (e.g. reservoirs), which offer protection from control	Impacts biodiversity values through browsing vegetation and competing with native fauna. Decreases livestock productivity.
Deer (<i>Cervidae</i>) – various species	Locally common in the catchments and associated riparian areas	Impacts to agricultural values including orchards, pasture and plantations. Impacts to native vegetation through browsing, erosion and limiting regeneration.
European Brown Hare (<i>Lepus europaeus</i>)	Locally common in western areas, especially where rabbits have been controlled	Grazing impacts to native vegetation and crops. Tree damage through gnawing bark. Impacts to native fauna, through competition and potentially facilitating the persistence or spread of introduced predators.

Priority Sites for Pest Animal Management

Effective pest animal management requires the strategic, targeted and consistent allocation of resources to manage a potentially widespread and pervasive problem.

Melbourne Water sites for pest animal management have been identified according to three criteria:

- Sites with identified high environmental values
- Sites containing physical assets requiring protection
- Sites managed to protect public health

By taking a strategic approach, the intention is to achieve increased effectiveness of pest animal management by Melbourne Water. However, reasons for undertaking pest animal management at each individual site must be determined in more detail through the development of an LPAAP, as site requirements may differ. The Pest Animal Guidelines are a technical reference for the management of particular species and should be used when developing an LPAAP.

Natural Assets

Areas of high natural value are identified, based on nine criteria, including:

- Threatened Flora
- Threatened Fauna
- Ecological Vegetation Classes
- BioSites
- Remnant Vegetation Extent

- Vegetation Condition
- Area to Perimeter Ratio
- Vegetation Complexity
- Connectivity

Physical Assets

The impact of pest animals on physical infrastructure generally impacts the delivery of Melbourne Water's services and areas where this occurs are usually well known.

Public Health

Public health could be compromised by pest animals through impacts to water quality (e.g. faecal contamination in closed catchments and animal carcasses in open aqueducts) and sewage treatment (e.g. sewage spills into the environment). Areas where these impacts could take place are relatively well known.

Strategy for Pest Animal Management

Vision and Objectives for Pest Animal Management

Melbourne Water's Strategic Framework identifies our long term vision of 'working together to ensure a sustainable water future'. This Strategy's vision aligns with the Strategic Framework's Natural Environment intent to: 'Protect, conserve and improve natural assets and use natural resources sustainably' and the Financial Management intent to: 'Maintain financial viability and increase business value through effective and efficient financial and risk management.'

The **vision** for pest animal management across Melbourne Water land can be stated as:

The targeted reduction in pest animal impacts will protect Melbourne Water's environmental, financial and social values, and its capability to safeguard successful outcomes for its activities.

This Strategy's vision can be realised through the achievement of eight specific **objectives** for pest animal management. These objectives are listed below.

1. Ensure pest animal management is undertaken in a strategic and coordinated manner
2. Reduce the impacts of pest animals on Melbourne Water land
3. Prevent new infestations of pest animals on Melbourne Water land`
4. Increase understanding of the impacts of pest animals and the effectiveness of control activities
5. Increase awareness of Melbourne Water's approach to pest animal management among stakeholders and the community
6. Develop a collaborative approach to pest animal management
7. Manage the impacts associated with pest animal control in a holistic manner

- 8. Ensure pest animal management is responsive to changing circumstances.

The success of this Strategy in delivering the vision and meeting these objectives will be evaluated through each action’s performance. The Pest Animal Guidelines and LPAAP are the tools that enable actioning of these objectives.

Pest Animal Management Cycle

A strategic Pest Animal Management Action Cycle is adopted to achieve the vision of this Strategy. This cycle has five broad steps (Figure 2). The steps are generally cyclic in nature, where the logical progression begins with collecting data to inform subsequent actions. Where there are perceived gaps in knowledge, further research may be necessary, as well as consultation and education to ensure the community and stakeholders are aware of key issues and priorities. Implementation is then undertaken, followed by monitoring at the site level. The overall success of pest animal management should be periodically reviewed to ensure intended outcomes are being achieved.

Figure 2 Pest Animal Management Action Cycle Categories



Data Collection

Accurate information is critical in prioritising and planning on-ground action so that resources are allocated in the most effective manner, and in areas where the greatest long term benefits can occur. While some reactive pest animal management may be required in response to critical or unforeseen situations, it is important that constant

progress is made towards long term goals. The collection, maintenance and analysis of data relating to pest animals should be rigorous and contained in a central database.

While natural and physical values have been mapped across land managed by Melbourne Water, these values do not remain static over time. The mapping of natural values will need to be periodically reviewed and recalculated based on the most current spatial data, monitoring results and stakeholder feedback (see Action 5). Data relating to pest animal impacts on infrastructure assets will be generated through the operational monitoring and maintenance of these areas, and will also be incorporated into the pest animal database.

Sites need to be assessed during the LPAAP process regarding the extent of the threat posed by pest animals to values. This assessment needs to be based on relevant scientific literature, government documents (i.e. threatening processes and threat abatement plans), staff and stakeholder consultation, and community feedback. In future, the collection of data relating to pest animal distributions and impacts will allow threats to be assessed and mapped similarly to natural values.

Action 1: Data Collection

A1.1 Monitor, collect and analyse data on values (natural, physical and social) and threats (pest animal distributions and impacts), including identifying newly-released datasets, to ensure that identified priority areas are appropriate.

A1.2 Migrate all data collection and maintenance to a central data location.

Consultation, Research and Education

It is recognised that further consultation with landholders and the community is required to progress management activities and meet pest animal management objectives. Ongoing consultation with State and local government land managers is necessary to ensure a common understanding of priority areas and pest species, and to develop a collaborative pest animal management approach, wherever possible.

Stakeholder consultation has highlighted existing opportunities for collaborative research and monitoring projects with universities, agencies and private organisations (see Appendix B). Many stakeholders expressed a willingness to collaborate on future projects, including biodiversity monitoring programs (e.g. Birds Australia, Field Naturalists Club of Victoria) and innovative pilot control programs such as using M-44 ejectors and/or infrared cameras (e.g. DPI, Hume City Council, Parks Victoria). The development of these programs will not only increase capacity building and the knowledge and experience of staff, but may also decrease the costs of research and monitoring programs.

Action 2: Consultation, Research and Education

- A2.1** Adjacent landholders and relevant stakeholders will be consulted and given the opportunity to be involved in the development of LPAAPs.
- A2.2** Undertake a proactive consultation process with State government agencies, local government and private industry and organisations, with the goal of developing large-scale pest animal management programs.
- A2.3** Develop and utilise resource material to educate and raise awareness regarding both the need to manage pest animals, and what is being done by Melbourne Water.
- A2.4** Support collaborative research projects with learning institutions, community groups, organisations and government agencies.

Implementation

A key component of developing an LPAAP is to proactively develop collaboration with landowners adjacent to the priority area, to determine both the extent of the management area, and the resources available for implementation.

It is likely that unforeseen pest animal management issues requiring priority attention will emerge over the short-medium term and planning and future funding will need to consider these issues, which may include the following:

- Events which substantially alter the distribution or impacts of pest animals (i.e. the 2009 bushfires)
- New or emerging species/populations of pest animals, which will require a rapid response
- Small scale works in response to requests or proposals by landholders or community groups (provided they align with the intent of the Strategy) and has long term benefits through capacity building.

A key consideration Melbourne Water encourages is the use of innovative control and monitoring techniques in pest animal management programs, such as M-44 ejectors for foxes and dogs, GIS technology to record spatial data, and camera trapping to monitor native and pest species (see Guidelines). These techniques should be incorporated into LPAAPs, where practicable, and pilot control programs, where the opportunity exists.

In many areas, pest animals have resulted in changes to the landscape, which may have compromised the ability of the ecosystem to recover when pest animals are removed. The requirement for maintenance activities (e.g. revegetation, fencing or weed control) during or following pest control will be considered during the LPAAP development process.

The implementation of on-ground works and associated activities (conducted primarily through the LPAAP process) should align with the vision and objectives of this Strategy.

Monitoring

Monitoring is essential in pest animal management activities, and will be incorporated as a comprehensively planned and costed component of any control program. In some areas, monitoring may constitute a substantial percentage of the overall budget of a control program. Every LPAAP will require a detailed plan relating to objectives and monitoring and how these are to be achieved. The delivery of monitoring and reporting will need to be supported by effective data management systems.

Baseline monitoring, or the monitoring of an area that is not subject to pest animal control, may also be required for areas where there is evidence or concern that pest animals may impact values.

As pest animal management aims to reduce the *impacts* of pest animals and not abundance per se, operational monitoring (i.e. kills, baits taken, etc.), while important, should not form the basis for assessing the effectiveness of a control program. A suitable method of performance monitoring, where the value(s) being impacted is monitored, will be incorporated in control programs, wherever practicable. At representative sites, or where there is an identified knowledge gap, a more extensive long-term monitoring program may be appropriate, to assess in detail the impacts of pest animals, and their control, on specific values.

Action 4: Monitoring

- A4.1** Incorporate a suitable monitoring protocol in the development of all LPAAPs, stipulating techniques, personnel, timeframes, data management and funding.
- A4.2** Use GIS technology in monitoring programs, wherever practicable, to capture spatial data on pest animal distribution, impacts, and control activities.

References

Butz Huryn V.M. 1997. Ecological impacts of introduced honey bees. *Quarterly Review of Biology* 72, 275-297.

Choquenot D., McIlroy J. and Korn T. 1996. *Managing vertebrate pests: Feral pigs*. Bureau of Resource Sciences, Canberra.

Coutts-Smith A.J., Mahon P.S., Letnic M. and Downey P.O. 2007. *The threat posed by pest animals to biodiversity in New South Wales*. Invasive Animals Cooperative Research Centre, Canberra.

CSIRO. 2008. *European Wasp: Fact sheet*. Commonwealth Scientific and Industrial Research Organisation. Updated 01/11/08. Available URL: <http://www.csiro.au/resources/European-wasps.html>

DECCW. 2008. Predation by the plague minnow (*Gambusia holbrooki*) - Key threatening process listing (29 January 1999). Department of Environment, Climate Change and Water, NSW Government.

Dexter N. and Murray A. 2009. The impact of fox control on the relative abundance of forest mammals in East Gippsland, Victoria. *Wildlife Research* 36, 252-261.

DPI. 2008. *A guide for the control over the possession, trade and movement of declared pest animals*. Department of Primary Industries, Melbourne.

DPI. 2009. *Invasive plants and animals policy framework* (draft). Department of Primary Industries, Melbourne.

Fleming P., Corbett L., Harden R. and Thomson P. 2001. *Managing the impacts of dingoes and other wild dogs*. Bureau of Rural Sciences, Canberra.

Forsyth D.M., Hone J., Parks J.P., Reid G.H. and Stronge D. 2003. Feral goat control in Egmont National Park, New Zealand, and the implications for eradication. *Wildlife Research* 30, 437-450.

Forsyth D.M., Duncan R.P., Bomford M. and Moore G. 2004. Climatic suitability, life-history traits, introduction effort, and the establishment and spread of introduced mammals in Australia. *Conservation Biology* 18(2), 557-569.

Gibson J. and West P. 2006. *Summary of State/Territory invasive animal distribution and abundance monitoring*. Report prepared for Invasive Animals Cooperative Research Centre.

Gong W., Sinden J., Braysher M. and Jones R. 2009. *The financial impacts of vertebrate pests in Australia*. Invasive Animals Cooperative Research Centre, Canberra.

Hall G.P. and Gill K.P. 2005. Management of wild deer in Australia. *The Journal of Wildlife Management* 69, 837-844.

IACRC. 2007. *Invasive Animals Cooperative Research Centre*. Available URL: <http://www.invasiveanimals.com/invasive-animals/>

Lindeman M.J. and Forsyth D.M. 2008. *Agricultural impacts of wild deer in Victoria*. Arthur Rylah Institute for Environmental Research, Technical Report Series No. 182. Department of Sustainability and Environment, Heidelberg, Victoria.

Melbourne Water. 2009. *Pest Animal Guidelines: A Management Guide for Melbourne Water Employees*. Prepared for Melbourne Water by AECOM Australia.

- Melbourne Water. 2009. *Guide to Developing Local Pest Animal Action Plans*. Prepared for Melbourne Water by AECOM Australia.
- NRMMC. 2007. *Australian Pest Animal Strategy*. Natural Resource Management Ministerial Council, Canberra.
- Olsen P. 1998. *Australia's pest animals: New solutions to old problems*. Bureau of Resource Sciences, Canberra.
- Parkes J., Henzell R. and Pickles G. 1996. *Managing vertebrate pests: Feral goats*. Australian Government Publishing Service, Canberra.
- Reddiex B., Forsyth D.M., McDonald-Madden E., Einoder L.D., Griffioen P.A., Chick R.R. and Robley A.J. 2006. Control of pest mammals for biodiversity protection in Australia. I. Patterns of control and monitoring. *Wildlife Research* 33, 691-709.
- Risbey D.A., Calver M.C. and Short J. 1999. The impact of cats and foxes on the small vertebrate fauna of Heirisson Prong, Western Australia. I. Exploring potential impact using diet analysis. *Wildlife Research* 26, 621-630.
- Saunders G., Coman B., Kinnear J. and Braysher M. 1995. *Managing vertebrate pests: Foxes*. Bureau of Rural Sciences, CSIRO.
- Saunders G. and McLeod L. 2007. *Improving fox management strategies in Australia*. Bureau of Rural Sciences, Canberra.
- Sharp T. and Saunders G. 2004a. *Ground shooting of hares (HAR001)*. NSW Department of Primary Industries.
- Sharp T. and Saunders G. 2004b. *Model code of practice for the humane control of feral cats*. NSW Department of Primary Industries.
- Simberloff D., Parker I.M. and Windle P.N. 2005. Introduced species policy, management, and future research needs. *Frontiers in Ecology and the Environment* 3(1), 12-20.
- Spencer R.J. 2009. *Developing Innovative Cost-saving Fox Control Technologies at WTP*. Unpublished Research Proposal, prepared for Melbourne Water.
- Steffen W., Burbidge A.A., Hughes L., Kitching R., Lindenmayer D., Musgrave W., Smith M.S. and Werner P.A. 2009. *Australia's biodiversity and climate change: A strategic assessment of the vulnerability of Australia's biodiversity to climate change*. A report to the Natural Resource Management Ministerial Council commissioned by the Australian Government. CSIRO Publishing.
- Triggs B., Brunner H. and Cullen J.M. 1984. Food of fox, dog and cat in Croajingalong National Park, south-eastern Victoria. *Australian Wildlife Research* 11, 491-9.
- White P.C.L., Ford A.E.S., Clout M.N., Engeman R.M., Roy S. and Saunders G. 2008. Alien invasive vertebrates in ecosystems: pattern, process and the social dimension. *Wildlife Research* 35, 171-179.
- Williams K., Parer I., Coman B., Burley J. and Braysher, M. 1995. *Managing vertebrate pests: Rabbits*. Bureau of Rural Sciences, CSIRO

Appendix A: Criteria, Rationale, Measure and Limitations for Selection of sites

Criteria	Rationale	Measure	Limitations
Regulatory Compliance			
1. Threatened Flora	<p>The Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth) (EPBC Act) and Flora and Fauna Guarantee Act 1988 (Victoria) (FFG Act), provide for the listing of taxa (genera, species, subspecies, varieties) and communities of flora which are threatened with extinction, giving them legal protection and allowing for actions to be undertaken for their protection to promote the recovery of such species. DSE also maintain Threatened Species Advisory Lists of Victorian rare or threatened species, which are based on technical information and advice from experts. These species are considered by regulatory bodies during a range of planning processes.</p> <p>The presence of a listed (threatened) flora species is an important element of prioritising management actions to meet regulatory requirements for managing threatened species. These species are usually the focus of state and federal actions to facilitate their recovery and can also be associated with community interest and involvement in recovery actions.</p>	<p><i>Number of Threatened Flora Species</i></p> <p>This value will be divided by the highest value recorded to get a standardised score between 0 and 1.</p> <p>Threatened flora species will included species listed under:</p> <ul style="list-style-type: none"> • EPBC Act • FFG Act • DSE Advisory Listing Species 	<p>The flora dataset is based on records collected from the field. The dataset is not an absolute measure of the number of species present on a site and a lack of records could be due to a lack of field assessment and searching. Therefore geographic data gaps may occur.</p> <p>Nevertheless, management actions can only be targeted towards known populations of threatened flora.</p>

<p>. Threatened Fauna</p>	<p>The EPBC Act and FFG Act provide for the listing of taxa (genera, species, subspecies, varieties) and communities of fauna which are threatened with extinction, giving them legal protection and allowing for actions to be undertaken for their protection to promote the recovery of such species</p> <p>The presence of a listed (threatened) fauna species is an important element of prioritising management actions to meet regulatory requirements for managing threatened species. These species are usually the focus of state and federal actions to facilitate their recovery and can also be associated with community interest and involvement in recovery actions.</p>	<p><i>Number of Threatened Fauna Species</i></p> <p>This value will be divided by the highest value recorded to get a standardised score between 0 and 1.</p> <p>Threatened fauna species will included species listed under:</p> <ul style="list-style-type: none"> • EPBC Act • FFG Act • DSE Advisory Listing Species 	<p>The fauna dataset is based on records collected from the field. The dataset is not an absolute measure of the number of species present on a site and a lack of records could be due to a lack of field assessment and searching. Therefore geographic data gaps may occur.</p> <p>Nevertheless, management actions can only be targeted towards known populations of threatened fauna.</p> <p>Migratory bird species listed under the CAMBA, JAMBA or ROKAMBA agreements are not included in this criterion, as spatial data for these species is lacking.</p>
<p>3. Ecological Vegetation Classes (EVCs) Conservation Status</p>	<p>EVCs are a key unit used for mapping, biodiversity planning and conservation assessment of Victoria’s vegetation types. EVCs are categories of vegetation types that consist of one or a number of floristic communities that have similar ecological characteristics or processes. There are approximately 300 EVCs in Victoria and each EVC is assigned one of the following conservation statuses: Presumed Extinct, Endangered, Vulnerable, Depleted, Rare and Least Concern.</p> <p>Sites which are found to contain EVCs of high conservation value are important to the State of Victoria in terms of biodiversity strategies and the native vegetation management framework. The proposed measurement system assumes that the more endangered the species, the more important it is in terms of management actions.</p>	<p><i>Highest Bioregional Conservation Status (BCS) score of EVCs present on the land parcel</i></p> <p>This value will be divided by the highest value recorded to get a standardised score between 0 and 1.</p> <p>The BCS scores are:</p> <ul style="list-style-type: none"> • Endangered = 5 • Vulnerable = 4 • Rare = 3 • Depleted = 2 • Least Concern = 1 • No EVCs = 0 	<p>EVC data is based on modelling, is designed for use at a large scale (1:25,000 to 1:100,000) and is not definitive at the site or property scale.</p>

4. Sites of biological significance	<p>Sites of biological significance are recognised as contributing to the conservation of Victoria’s native biodiversity. The significance of sites are characterised as International, National, State, Regional (bioregional), and Local, based on a range of values, such as the ecological integrity, viability, naturalness, richness of biodiversity, conservation status and representativeness of the sites.</p> <p>The assessment and classification of biological significance identifies Victorian priority areas for conservation management action and reservation, and facilitates the incorporation of biological conservation objectives into regional and local planning procedures¹. The proposed measurement system assumes a hierarchy of importance between the local and international levels.</p>	<p><i>Highest Biosite score present on the land parcel.</i></p> <p>This value will be divided by the highest value recorded to get a standardised score between 0 and 1.</p> <p>The Biosites scores are:</p> <ul style="list-style-type: none"> • International Biosite = 5 • National Biosite = 4 • State Biosite = 3 • Regional Biosite = 2 • Local Biosite = 1 • No Biosite = 0 	Spatial accuracy varies from 1:25,000 to 1:100,000.
Ecosystem Function			
5. Remnant Vegetation Extent	<p>This criterion is based on the total area of remnant native vegetation (EVCs) estimated within each land parcel.</p> <p>This criterion assumes that generally, larger areas of remnant vegetation have greater value as they are able to support more plants and animals of different types.</p>	<p><i>Total area of EVC present on the land parcel measured in hectares</i></p> <p>This value will be divided by the highest value recorded to get a standardised score between 0 and 1.</p>	EVC data is based on modelling, is designed for use at a large scale (1:25,000 to 1:100,000) and is not definitive at the site or property scale.

¹ Standard Criteria for Sites of Biological Significance in Victoria, DSE, December 2004

6. Vegetation Condition	<p>Vegetation condition is a measure of the quality of an EVC relative to a benchmark condition. Condition is based on the habitat hectare assessment method and assesses factors including: number large trees, tree canopy cover, understorey, weeds, recruitment, organic litter and logs. A site condition model has been published by DSE which predicts the condition of native vegetation.</p> <p>It is assumed that EVCs in better condition will be more resilient to disturbance and provide increased resources and habitat potential.</p>	<p><i>Habitat Hectare modelled Site Condition score</i></p> <p>This value will be divided by the highest value recorded to get a standardised score between 0 and 1.</p> <p>If multiple EVCs are present on the land parcel then the average score will be calculated.</p>	<p>EVC data is based on modelling, is designed for use at a large scale (1:25,000 to 1:100,000) and is not definitive at the site or property scale.</p>
7. Area to Perimeter Ratio	<p>The area to perimeter ratio of a remnant vegetation block is often used as a surrogate for vegetation condition. The assumption being that threatening processes are likely to occur at the interface between remnant and non-remnant vegetation. Therefore, a parcel with a smaller area to perimeter ratio is likely to be more susceptible to threatening processes.</p> <p>Remnants with a high ratio are less prone to 'edge effects' and therefore generally have a higher resilience to degradation, including pest species impacts.</p>	<p><i>Sum of area of vegetation blocks that intersect land parcel (m²) / Sum of perimeter of vegetation blocks that intersect land parcel (m)</i></p> <p>This value will be divided by the highest value recorded to get a standardised score between 0 and 1.</p> <p>Vegetation blocks will be collated by aggregating the EVCs to form vegetation polygons.</p>	<p>The area to perimeter calculation is an aggregation of total areas and perimeters on a parcel.</p>
8. Vegetation Complexity	<p>This criterion is based on the total number of EVC types recorded within a land parcel per hectare.</p> <p>This criterion measures the diversity of vegetation communities and assumes that a higher diversity indicates more variability within ecosystems and therefore more habitat potential for a variety of species.</p>	<p><i>Total number of EVCs</i></p> <p>This value will be divided by the highest value recorded to get a standardised score between 0 and 1.</p>	<p>The flora dataset is based on records collected from the field. The dataset is not an absolute measure of the number of species present on a site and a lack of records could be due to a lack of field assessment and searching.</p>
9. Connectivity	<p>Connectivity refers to the pathways available for certain mobile animals and birds to disperse and migrate between vegetation patches.</p> <p>This criterion recognises that proximity to vegetation areas, particularly native vegetation, has potentially important ecological value for migration, mobility and maintaining genetic diversity. The criterion aims to measure if the land parcel is isolated or in close proximity to other vegetation areas in the landscape.</p>	<p><i>Habitat hectare patch-based landscape context model score</i></p> <p>This value will be divided by the highest value recorded to get a standardised score between 0 and 1.</p> <p>If multiple EVCs are present on the land parcel then the average score will be calculated.</p>	<p>EVC data is based on modelling, is designed for use at a large scale (1:25,000 to 1:100,000) and is not definitive at the site or property scale.</p>

Appendix B: Summary of Consulted Key Stakeholders

Ian Lane Contractor Barongarook Weed and Vermin Control
Dr Graeme Lorimer Convener Friends of Bungalook Conservation Reserves Member Montrose Environment Group
Justin Jemmeson Fire and Forest Officer DSE, Powelltown
Glenn Lineham Senior Wild Dog Controller, DPI Vaughn Kingston Community Engagement Wild Dogs, DPI Ryan Cooke Project Manager, Port Phillip & Corangamite, DPI

Juliana Riotto Sustainable Land Management Officer Hume City Council
Bridie Wetzel Land Management Officer Hume City Council
Maelor Himbury Minute Secretary Friends of Maribyrnong Valley
Phil Pegler Manager, Healthy Parks Program Parks Victoria
Mark Smith Biodiversity Programs Coordinator Port Phillip and Westernport CMA
Lori Arthur Land Management Officer Nillumbik Shire Council

Janelle Thomas Threatened Bird Network Coordinator Birds Australia
Marty White Coordinator Biodiversity Conservation Yarra Ranges Shire
Rowan Hore Coordinator Bushland and Trails Yarra Ranges Shire
Dr Hugh Wirth President Royal Society for the Prevention of Cruelty to Animals (RSPCA)
Natasha Baldyga Land Management Group Coordinator City of Whittlesea

Fauna Survey Group Field Naturalists Club of Victoria
Tim Bloomfield Grow West Coordinator Port Phillip and Westernport CMA

