Southern Brown Bandicoot Management Plan

The Pines Flora and Fauna Reserve

May 2015

Document citation

Linking Melbourne Authority. 2015. Southern Brown Bandicoot Management Plan – Pines Flora and Fauna Reserve. Version 1.

Document version details

Version number	Version 2.
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Date of issue	May 2015

Previous versions

Version 1 – Feb 2014

Original - 2012

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Glossary and acronyms

ARCUE	Australian Research Centre for Urban Ecology
DARA	Department of Agriculture and Rural Affairs
DEPI	epartment of Environment and Primary Industries
EWHA	epartment of Environment, Water, Heritage and The Arts
DOTE	Commonwealth Department of the Environment
DPI	Department of Primary Industries
DSE	Department of Sustainability and Environment (until late 2012 when changed to DEPI)
DSEWPaC	Department of Sustainability, Environment, Water, Population and Communities (until late 2013 when changed to DOTE)
ECD	Ecological Character Description
EES	Environment Effects Statement
EPBC Act	Environment Protection and Biodiversity Conservation Act (Commonwealth) 1999
EVC	Ecological Vegetation Class
FCC	Frankston City Council
KTRI	Keith Turnbull Research Institute
Langwarrin FFR	Langwarrin Flora and Fauna Management Reserve
LMA	Linking Melbourne Authority
Pines FFR	The Pines Flora and Fauna Management Reserve
PVA	Population Viability Analysis
RBGC	Royal Botanic Gardens Cranbourne
SBB	Southern Brown Bandicoot
UGB	Urban Growth Boundary - The urban growth boundary indicates the long-term limits of urban development and where non-urban values and land uses should prevail in metropolitan Melbourne
UGZ	Urban Growth Zone - The Urban Growth Zone applies to land that has been identified for future urban development. The UGZ has four purposes: • to manage the transition of non-urban land into urban land • to encourage the development of well-planned and well-serviced new urban communities in accordance with an overall plan • to reduce the number of development approvals needed in areas where an agreed plan is in place • to safeguard non-urban land from use and development that could prejudice its future urban development.

Executive Summary

Purpose and scope

This plan provides a strategy and detailed management plan for the nationally threatened Southern Brown Bandicoot (SBB) (*Isoodon obesulus*) within the Pines Flora and Fauna Management Reserve (the Pines FFR) as part of the construction and operation of the Peninsula Link Project, Victoria. Peninsula Link was opened in January 2013.

The SBB present in Victoria belongs to the south-eastern mainland sub-species (*Isoodon obesulus obesulus*). This population is now considered in danger of extinction throughout south-eastern mainland Australia and is listed as "Endangered" under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act). The subspecies is also listed as "Threatened" under the Victorian *Flora and Fauna Guarantee Act 1988* (Vic) (Department of Sustainability and Environment , 2011).

This management plan has been developed in order to meet the obligations under the EPBC Act approval (EPBC 2007/3480) and the assessment by the Victorian Government Minister under the *Environment Effects Act 1978* (Vic) for the Peninsula Link project. This management plan is an updated version of the Southern Brown Bandicoot Management Plan: Pines Flora and Fauna Reserve (ARCUE, 2010).

The Pines Flora and Fauna Reserve

The Pines FFR is a 240 hectare area containing significant remnants of heathy woodland and heathland vegetation. The reserve is a Biosite of State significance and provides habitat for species protected under the EPBC Act and the *Flora and Fauna Guarantee Act 1988* (Vic).

Parks Victoria manages the Pines FFR in accordance with the approved Master Plan for the Greater Pines Reserve (LMA, 2010) as well as a range of other general strategies, plans and operational policies and guidelines. Future management of the Pines FFR will be in accordance with a Management Statement to be prepared in 2014/15 by Parks Victoria.

Status of the Southern Brown Bandicoot in the Pines Flora and Fauna Reserve

SBBs once occurred commonly in the wider Frankston area (pre-1970s). The SBB has rapidly declined and is now restricted to isolated remnant habitat patches. Presently there are only two known populations within 15 km of the Pines FFR, namely the Royal Botanic Gardens Cranbourne (RBGC) and at Quail Island in Western Port Bay. The population at RBGC is the only population in the greater Melbourne area large enough and managed appropriately to be considered secure, although recent monitoring indicates that the population on Quail Island may exceed 600 animals.

Records indicate that the Pines FFR recently had one of the last confirmed populations of SBB on the Mornington Peninsula. The results of monitoring over the past four years show that within the Pines FFR only a few individuals remain or they may now be locally extinct.

Threats in the Pines Flora and Fauna Reserve

The Pines FFR is both an important conservation area and a community asset for recreation. It will continue to be managed for multiple uses. The key threats to SBB persistence in the Pines FFR are thought to include predation and inappropriate fire regimes. Connectivity to surrounding habitat patches and habitat loss within the Pines FFR are also likely to be important factors in the survival of any remaining SBB population.

While there is ongoing predator control within the Pines FFR, due to relatively high numbers of foxes in urban areas, and limitations on broad-scale control in surrounding areas, there will be persistent risks of fox predation at variable levels into the future.

In addition to predation threats, the Pines FFR has had a high incidence of fire and a major portion of the reserve has been burnt over the past 20 years. The majority of fires have been deliberately lit through arsonist activity and the Pines FFR may continue to have inappropriate fires due to potential arson activity. Climate change is predicted to increase the risk of more intense and severe fires.

Connectivity under Peninsula Link is maintained by the provision of a major underpass and number of culverts with further opportunities for connectivity provided through drainage crossings and the emergency vehicle underpass.

The Pines FFR is generally isolated from other significant habitat remnants. Further isolation is expected through additional development in the surrounding area. Planning processes need to consider appropriate ecological connections when approving developments and there is limited opportunity for the Pines FFR to be ecologically connected due to the surrounding land use. Planning has been recently initiated by the Frankston City Council to investigate opportunities for enhanced fauna connectivity within the municipality.

The Pines FFR is currently subject to a relatively high level of inappropriate human activities including arson, vandalism of fences, gates and other infrastructure, trail bike riding, allowing dogs off leash and dumping of cars and rubbish. These threats have potential to impact on the viability of any remaining SBB population in this area, particularly through fence and gate vandalism and arson.

Parks Victoria wishes to enhance adjacent community accessibility and advocacy for the reserve in order to raise community awareness of the reserve's environmental and social values, encourage appropriate use and over time discourage inappropriate activities.

Population viability of the Southern Brown Bandicoot in the Pines Flora and Fauna Reserve

A population viability analysis (PVA) for SBB in the Pines FFR has been conducted. The PVA showed that, without some direct management interventions, the population of SBB at the Pines FFR is highly likely to become extinct within the modelling timeframe (being sometime in the next 1 to100 years). All scenarios with the addition of a well maintained, predator proof fence around the perimeter or a smaller enclosed area of the reserve improved the viability of SBB at the Pines FFR.

However, neither Parks Victoria nor DEPI (previously known as DSE) support the installation of a predator proof fence. Parks Victoria is convinced that a predator proof fence at the Pines FFR will not achieve objectives for sustainable recovery of the SBB in the reserve due to the level of current and expected on-going threats. In addition, a fence would require substantial clearing of vegetation of State significance and result in significant native vegetation offset implications.

Parks Victoria and DEPI indicated that a fence is not justified in context of the limited number of SBB that may currently persist in the Pines FFR compared with the cost of the fence installation and in consideration of the objectives of the Sub Regional Strategy for the SBB. A fence will have direct impacts on biodiversity values through vegetation clearance and social impacts through expected community perceptions of inaccessibility and reduced opportunities to benefit from recreation and connect with nature.

It is therefore proposed that the EPBC approval condition to install and maintain a predator proof fence around the boundary of the Pines FFR be amended to allow alternative management options for the recovery of the SBB to be prioritised.

As stated in the PVA, regardless of the management actions implemented (well maintained fence, predator control etc), translocation (population reintroduction) would be required in the Pines FFR to supplement the existing population until it is large enough to withstand threatening processes. However, no translocations should be considered until the major risks or threats at the Pines FFR may be controlled to a level that would allow the SBB population to remain viable and self-sustaining.

Strategic management of the Southern Brown Bandicoot

DEPI is the lead agency for the strategic management of the SBB. It is currently reviewing its species specific management, strategy and action plans. At this stage, the Pines FFR is not identified as a critical habitat area or population for the SBB in the region as it is isolated and within an urban environment. DEPI is focusing on maintaining and improving connectivity in a way that enhances overall habitat availability at a landscape scale and identifying long-term actions to guide investment and planning for the recovery of SBB.

The objectives for this SBB Management Plan focus on:

a) implementing the *Advice Regarding Strategies for the Protection of Southern Brown Bandicoot* (Biosis 2013). LMA considers that the funding available for the predator-proof fence will be more effectively used for the protection and recovery of SBB where it is provided in the context of the co-ordinated regional and sub-regional approach.

b) enhancing SBB habitat at the Pines FFR, in accordance with Parks Victoria's key management directions for the reserve. This is in order to provide suitable habitat in the event that future connectivity corridors are secured to facilitate SBB movement from other locations.

Objectives and management actions

The objectives for this SBB Management Plan are:

- To monitor for presence/absence of SBB within the Pines FFR utilising the fauna underpasses and aim to protect any SBB population that may persist
- To survey any incidental signs of SBB presence within the Pines FFR that may be recorded by Parks Victoria Rangers and volunteers
- To monitor the fauna underpasses and their use by other fauna including predators
- To track habitat condition for SBB within the Pines FFR. The aim would be to provide information to inform Parks Victoria's progress in maintaining and restoring the condition of EVCs and to facilitate adaptive management responses as may be determined necessary to improve the habitat condition
- To contribute to the implementation of an alternative strategy for the recovery of the SBB in the south-east of Melbourne

The management actions measures to be implemented by various state authorities (LMA, Parks Victoria and DEPI) over at least seven years post construction of Peninsula Link (2014- 2020) are summarised by reference to the EPBC Approval conditions in the table below:

Management Activity	EPBC Condition	Action/Performance Criteria
Acquisition of KTRI land	2(a)	Completed – therefore not included in revised plan.
Revegetation of 16Ha the former orchard	2(b)	LMA and Parks Victoria will continue with implementation of the revegetation of the former orchard, in accordance with The Pines Flora and Fauna Reserve Revegetation Plan for the Former Orchard Site, September 2010.
Predator control and monitoring	2(c)	LMA and Parks Victoria will continue with predator control and monitoring as outlined in revised plan.
Boundary Predator Proof Fence	2(c)	Alternative actions as agreed with DEPI and DSWEPaC to be implemented for the protection of SBB in the region.
Impact thresholds that trigger intervention	2(c)	The SBB population in the Pines FFR is limited to a few individuals or locally extinct. Impact thresholds cannot be applied.
Provision of underpass and culverts	2(d)	Completed – therefore not included in revised plan
SBB Monitoring	2(d)	LMA and Parks Victoria will continue with monitoring as outlined in the revised plan.
Population Viability Analysis	2(d)	Completed – therefore not included in revised plan
Discussion on offsets if population declines	2(e)	The SBB population in the Pines FFR is limited to a few individuals or locally extinct. Linked to alternative measures.
Funding of the plan	2(f)	Arrangements made for funding of the remaining seven years of the plan (2014- 2020)
Schedule, Timing and Responsibility	2(g)	Discussed in the revised plan
Review opportunities for connectivity	2(h)	LMA has prepared the ECD which provides an overview for the south east region. This will provide opportunities for connectivity
Revision of Plan	2(g)	Will be reviewed as indicated in revised plan
Mortality monitoring	Not a condition – Enhancement Measure	No SBB are expected to be found along Peninsula Link within the Pines FFR due to retaining walls and containment barriers and light spill walls.
Weed management	Not a condition – Enhancement Measure	LMA and Parks Victoria will continue with weed control works in accordance with The Pines Flora and Fauna Reserve Weed Management Plan (June 2010). Five year plan to be completed by 2015.
Fire management	Not a condition – Enhancement Measure	Parks Victoria will manage fire in accordance with Management Statement incorporating ecological burning
Monitoring of habitat condition	Not a condition – Enhancement Measure	Parks Victoria will undertake a flora assessment of the Reserve in 2018 which entails establishment of permanent quadrants to enable detection of changes in condition over time.
Weed monitoring	Not a condition	A weed monitoring program will be undertaken for weeds throughout the

Management Activity	EPBC Condition	Action/Performance Criteria
	– Enhancement Measure	Reserve area for two years after the implementation of initial weed management measures.
Revegetation site monitoring	Not a condition – Enhancement Measure	Monitoring of the revegetation site will commence in the first year of revegetation works and be undertaken then annually until year 5, before then being undertaken again in Year 10.
Alternative management actions	Alternative to boundary predator proof fence - Condition 2(c)	$1.6 million funding to contribute to the implementation of the alternative strategy for the protection of Southern Brown Bandicoot.

LMA will implement the management plan during the initial operational phases of the Peninsula Link Project (2013 to early 2014). It will then make arrangements for Parks Victoria to implement the management plan in accordance with the EPBC approval conditions. DEPI will also assist in guiding Parks Victoria in the strategic management of SBBs both within the Pines FFR and surrounding environs. Any strategic management required by Parks Victoria will be restricted to parks and reserves managed by Parks Victoria.

LMA will fund the review and implementation of the plan until early 2014 and then facilitate funding arrangements for the implementation of the plan for the remaining period (until year 2020), at which point the need for further monitoring and management measures will be reviewed. The management plan will undergo a series of formal and informal reviews during its lifetime.

1 Introduction

1.1 Purpose

This plan provides a strategy and detailed management plan for the nationally threatened Southern Brown Bandicoot (SBB) (*Isoodon obesulus*) within the Pines Flora and Fauna Reserve (the Pines FFR) as part of the construction and operation of the Peninsula Link Project, Victoria (formerly known as Frankston Bypass).

This management plan has been developed in order to meet the obligations under the *Environment Protection and Biodiversity Conservation Act 1999 (Cth)* (EPBC Act) and the assessment by the Victorian Government Minister under the *Environment Effects Act 1978 (Vic)*.

This management plan is a revised version of the Southern Brown Bandicoot Management Plan: Pines Flora and Fauna Reserve (ARCUE, 2010). The first version of the plan was prepared to allow construction of Peninsula Link under the conditions of the EPBC approval. The original plan identified the requirement for a revision to be submitted to the Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) by December 2012 addressing long-term SBB management within the Pines FFR.

The 2012 plan was not adopted and further work was undertaken to develop some long-term strategies. This revised management plan meets the requirement to address long-term SBB management within the Pines FFR.

1.2 Peninsula Link Project

Peninsula Link is a 27 kilometre freeway connecting EastLink in Carrum Downs to the Mornington Peninsula Freeway in Mount Martha (**Figure 1**). The project provides a freeway standard roadway with interchanges at key arterial cross-roads largely within the existing road reserve corridor, and includes the construction of a Shared Use Path generally along the alignment from Patterson River to south of Baxter.

Peninsula Link was opened in January 2013.

Peninsula Link bisects the Pines Flora and Fauna Reserve in Frankston North. All clearing of vegetation for Peninsula Link within the Pines FFR has been completed. The retaining walls and major and minor fauna underpasses and the access underpass have also been completed.

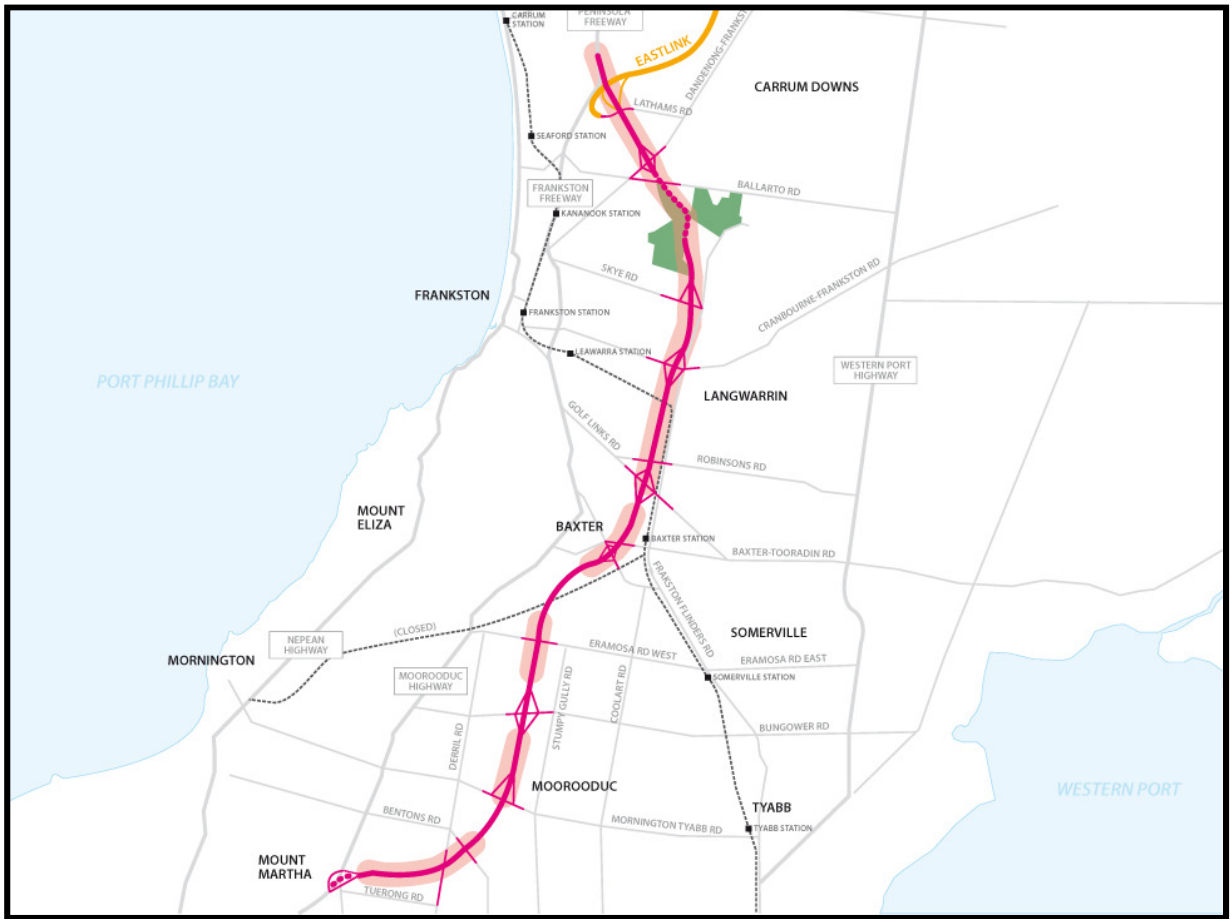

Figure 1 - Location of Peninsula Link, connecting to EastLink in Carrum Downs and the Moorooduc Highway in Mount Martha

1.3 Southern Brown Bandicoot in the Pines FFR

During the project planning phase, an Environment Effects Statement (EES) was prepared for the Peninsula Link Project which identified the potential for the SBB to occupy habitats within the road corridor and in particular within the Pines FFR in Frankston (Southern and Eastern Integrated Transport Authority, 2009)

The SBB present in Victoria belongs to the south-eastern mainland sub-species (*Isoodon obesulus obesulus*). The south-eastern mainland population of SBB is now considered in danger of extinction throughout south-eastern mainland Australia and has been subsequently listed as “Endangered” under the EPBC Act. The subspecies is also listed as “Threatened” under the Victorian Flora and Fauna Guarantee Act 1988 (Department of Sustainability and Environment (DSE), 2011).

1.4 Requirement for a management plan

Following referral to the then Department of Environment, Water, Heritage and the Arts (now DSEWPaC) for assessment, the Commonwealth Environment Minister approved the construction of Peninsula Link through the Pines FFR subject to a number of conditions of approval (EPBC 2007/3480 – *see http://www.environment.gov.au/epbc/notices/assessments/2007/3480/approval-decision.pdf*). This included the requirement for a SBB Management Plan.

The Southern Brown Bandicoot Management Plan: Pines Flora and Fauna Reserve, March 2010 (ARCUE, 2010) was prepared for the Linking Melbourne Authority (LMA) to satisfy its obligations under the EPBC Act to allow the construction of Peninsula Link, and was approved by the Commonwealth Environment Minister.

1.5 Requirement to revise the management plan

At the time of preparation of the Southern Brown Bandicoot Management Plan: Pines Flora and Fauna Reserve, March 2010 (ARCUE, 2010) there was limited information available on the abundance and distribution of SBB within the Pines FFR, with pre-construction surveys failing to detect SBBs within the Pines FFR.

Furthermore, a series of other studies that would potentially guide SBB management within the Pines FFR were either in preparation or required preparation. These included:

- Population Viability Analysis (PVA) (ARCUE, 2012a*)* to determine the effectiveness of management measures and recovery actions and the preparation of the

- Sub-regional Species Strategy for the Southern Brown Bandicoot (DSE, 2011, recently reviewed and replaced by DEPI, 2014).

The Southern Brown Bandicoot Management Plan Pines Flora and Fauna Reserve, March 2010 (ARCUE, 2010) identified the requirement for a revision to be submitted to DSEWPaC by December 2012 addressing post construction SBB management within the Pines FFR, as further information would become available during the construction of Peninsula Link. A plan was submitted prior to December 2012, however it was not adopted.

This revised SBB Management Plan satisfies the requirement to address post construction SBB management within the Pines FFR. The management plan objectives for this plan are detailed in Section 7.

1.6 Responsibilities

LMA is responsible for the Peninsula Link planning process, including obtaining statutory and planning approvals for construction. Southern Way was awarded a contract to design, construct, operate and fund Peninsula Link in accordance with the State's performance requirements. Compliance with the State's requirements has been audited and verified by LMA and an Independent Reviewer.

1.7 Stakeholder engagement

This management plan has been developed by LMA in consultation with Parks Victoria and DEPI.

DEPI, LMA and Parks Victoria have worked with the community throughout the process to ensure that their concerns and objectives are understood and considered.

In the development of this management plan, LMA has consulted with a range of stakeholders including local Councils, relevant State Government authorities, and community groups such as the Friends of the Pines Flora and Fauna Reserve as well as individual members of the community.

2 Conditions of approval

2.1 EPBC conditions relevant to Southern Brown Bandicoot

The Commonwealth Environment Minister approved the construction of Peninsula Link subject to a number of conditions of approval. This included the preparation of a SBB Management Plan which addressed the following requirements:

a) Acquisition of the land within the former Keith Turnbull Research Institute (KTRI), followed by its inclusion into the existing Pines FFR

b) Rehabilitation of the vegetation on the former orchard and KTRI to provide approximately 16 ha of additional SBB habitat

c) Predator control measures that include:

- Initiation and maintenance of a predator control and monitoring program in the Pines FFR
- Installation and maintenance of a predator proof fence around the boundary of the Pines FFR
- Identification of impact thresholds that will trigger management intervention

d) Monitoring and recovery actions for the SBB that include:

- Provision of a large underpass and a number of smaller culverts under the Frankston Bypass, as proposed in the Environment Effects Statement. The report needs to justify the placement and design of these structures
- Assessment of the effectiveness of the culverts and underpass for retaining connectivity of habitat for the SBB, which includes pre-construction monitoring for approximately six months and post-construction monitoring that continues for 10 years at which point of time the need for further monitoring will be reviewed
- The development of a Population Viability Analysis (PVA) to determine the effectiveness of all management measures and recovery actions undertaken for the SBB. The report needs to include a peer review of the completed PVA by a qualified expert

e) Discuss a range of options for offsets in the event that the SBB population in the Pines FFR continues to decline, including a last option of translocation

f) Arrangements to fund the implementation of the plan

g) Schedule of proposed works, timings and responsibilities

h) Review the opportunities for maintenance and creation of corridors for the SBB to enhance the connectivity of habitat in the region

i) A description of its objectives, performance criteria and corrective actions as well as provisions to review the plan regularly.

2.2 State assessment and requirements

The EES for the Peninsula Link Project identified the potential for the SBB to occupy habitats within the road corridor and in particular within the Pines FFR in Frankston.

Evidence of SBB was found within the Pines FFR during the EES field surveys. However, the population was considered to be small (Biosis Research, 2008). It was identified that construction of Peninsula Link through the Pines FFR would remove habitat for this species that may impact any existing populations. It was also identified that additional potential impacts may include the creation of barriers to movement, increased rates of mortality due to collision with vehicles and degradation of habitat due to other impacts such as weeds, noise, light and chemical pollution.

As detailed in the EES, impacts on the SBB would be mitigated by construction of a large fauna underpass and other smaller culverts to provide habitat connectivity. Additionally, the habitat area will be expanded through revegetation within the Pines FFR.

The State Minister's EES Assessment required the preparation, to the satisfaction of the Secretary of DSE, of a specific plan for the protection of the SBB within the Pines FFR before works proceeded in the reserve. The SBB Management Plan (ARCUE 2010) complied with this requirement.

2.3 Compliance status

The first version of the SBB Management Plan was written to allow a staged process for management of the SBB, as certain management actions were dependent on the outcomes of research (population viability analysis), monitoring (pre and during construction) and on strategic State Government management plans for the SBB. Therefore, the first version of the plan outlined key decision milestones, the responsible agency for each decision, and the commitments at key decision milestones.

A significant number of the EPBC conditions were relevant to pre-construction and construction of Peninsula Link and, as such, have been addressed.

Table 1 outlines a time and schedule, the agencies responsible and the compliance status (as of 20 January 2014) for the implementation of the SBB Management Plan (ARCUE 2010) and EPBC approval conditions.

Table 1 – EPBC conditions and compliance status of SBB Management Plan March 2010

EPBC Condition	Condition Details	Deliverable	Reference in SBB Management Plan (March 2010)	Timing SBB Management Plan (March 2010)	Responsibility	Compliance Status at January 2014	Reference in SBB Management Plan January 2014
2	repare a SBB Management Plan	SBB Management Plan.		Draft Feb 2010	LMA	SBB Plan (2010) was approved March 2010.	This plan.
		Implementation of SBB management plan pre construction and during construction.		Feb 2010 – Jun 2013	LMA	Complete.	
		Implementation of SBB management plan post construction.		July 2013 onwards	Refer to Section 5, 6, & 7 of the 2010 plan	Implementation underway by LMA and Parks Victoria.	Refer to section 8 of this plan
2(a)	The acquisition of the land within the former KTRI followed by its inclusion into the existing Pines FFR.	Land transfer from Department of Primary Industries (DPI) to Department Sustainability and Environment and Parks Victoria for management.	Section 4.7	Anticipated mid 2010	DEPI	Approximately 24.5 hectares of the former KTRI land has been acquired. The land has been reserved for public purposes for inclusion in the Pines FFR, and Parks Victoria is expected to be assigned management responsibility in the future.	Not included as item is complete.

EPBC Condition	Condition Details	Deliverable	Reference in SBB Management Plan (March 2010)	Timing SBB Management Plan (March 2010)	Responsibility	Compliance Status at January 2014	Reference in SBB Management Plan January 2014
2(b)	Rehabilitation of the vegetation on the former orchard and KTRI to provide approximately 16 ha of additional habitat for the SBB.	Draft Master Plan for the Pines to be finalised.	Section 4.7	April 2010	LMA and Parks Victoria	Greater Pines Reserve Master Plan (2010) finalised in June 2010.	Not included as item is complete.
		Pines Revegetation Plan.	Section 4.7	June 2010	LMA and Parks Victoria	The Pines Flora and Fauna Reserve Revegetation Plan for the Former orchard site (2010) was approved in September 2010.	Not included as item is complete.
		Revegetation plan will provide the staging and timeframe for the works. Implementation of works.	Section 4.7	From July 2010	LMA and Parks Victoria	Revegetation commenced and will continue in accordance with the Revegetation Plan.	Section 8.4.3
2(c)	Predator control measures that include: Initiation and maintenance of a predator control and monitoring program in the Pines FFR	Pre construction predator control and monitoring program.	Section 3.5	Commenced Oct 2009 to March 2010	LMA and Parks Victoria	Predator control was undertaken during the following periods: **Pre-construction**: Sept-Dec 2009 Feb-March 2010	Not included as item is complete.

EPBC Condition	Condition Details	Deliverable	Reference in SBB Management Plan (March 2010)	Timing SBB Management Plan (March 2010)	Responsibility	Compliance Status at January 2014	Reference in SBB Management Plan January 2014
		During construction predator control and monitoring program.	Section 4.2	April 2010 to Jun 2013	LMA and Parks Victoria	**Construction:** March-May 2011 March-April 2012 May 2013 Sand pad monitoring for fox activity was undertaken during fox control programs.	Not included as item is complete
		Post construction predator control and monitoring program.	Section 5.3	Jul 2013 onwards	Parks Victoria	Program being reviewed and will then be implemented	Section 8.3
	Installation and maintenance of a predator proof fence around the boundary of the Pines FFR	Design Report Installation	Section 6.2.1	December 2012 2013	Refer to Section 5, 6, & 7 of the 2010 plan	See Section 6.1 for discussion	See Section 6.1 for discussion

EPBC Condition	Condition Details	Deliverable	Reference in SBB Management Plan (March 2010)	Timing SBB Management Plan (March 2010)	Responsibility	Compliance Status at January 2014	Reference in SBB Management Plan January 2014
	Identification of impact thresholds that will trigger management intervention	Impacts to be identified after completion of pre-construction and during construction monitoring and incorporated into a formal review of plan (to be submitted to DEWHA 2012), as well as conclusion of PVA and pre-construction fox predator control program.	Section 6.4.3	Formal review of plan – 2012	LMA, Parks Victoria and DSE	SBB monitoring cannot provide an estimate of the abundance or distribution of SBB within the Pines FFR. See Section 6.2 for discussion.	See Section 6.2 for discussion
2(d)	Monitoring and recovery actions for the SBB that include:						
	Provision of a large underpass and a number of smaller culverts under the Frankston Bypass	Concept design in accordance with EES Requirements and Project Scope and Requirements	Section 4.5	2010	Southern Way	Large fauna underpass and 4 smaller fauna crossings have been constructed to provide for fauna connectivity.	Not included as item is complete.
	Assessment of the effectiveness of the culverts and underpass for retaining connectivity of habitat for the SBB, which includes pre-construction monitoring for approximately six months and post-construction monitoring that continues for	Pre-construction monitoring program.	Section 3.1	Sept 2009 – Mar 2010	LMA	SBB monitoring undertaken: **Pre-construction**: Spring 2009 Summer 2010 Autumn 2010	Not included as item is complete.

EPBC Condition	Condition Details	Deliverable	Reference in SBB Management Plan (March 2010)	Timing SBB Management Plan (March 2010)	Responsibility	Compliance Status at January 2014	Reference in SBB Management Plan January 2014
	10 years at which point of time the need for further monitoring program will be reviewed.	During construction monitoring program – to be developed after pre-construction monitoring program completed and results analysed.	Section 4.8	Apr 2010 - Jun 2013	LMA	**Construction:** Spring 2010 Spring 2011 Spring 2012 Monitoring of temporary fauna crossings undertaken for a 3 month period during 2011. Results provided in Spring 2011 SBB Monitoring Report.	Not included as item is complete

EPBC Condition	Condition Details	Deliverable	Reference in SBB Management Plan (March 2010)	Timing SBB Management Plan (March 2010)	Responsibility	Compliance Status at January 2014	Reference in SBB Management Plan January 2014
		Formal review of monitoring program. Long term monitoring program developed after during construction monitoring and two years post construction program completed and results analysed.	Section 5.1	Jun 2015	Parks Victoria	Post construction monitoring program has commenced. To be reviewed in 2015.	Section 8.1

EPBC Condition	Condition Details	Deliverable	Reference in SBB Management Plan (March 2010)	Timing SBB Management Plan (March 2010)	Responsibility	Compliance Status at January 2014	Reference in SBB Management Plan January 2014
	Development of a PVA to determine the effectiveness of all management measures and recovery actions undertaken for the SBB. The report needs to include a peer review of the completed PVA by a qualified expert.	The scope of the PVA has been developed.	Section 6.1	Jan 2010	LMA	PVA has been prepared during 2010 and 2011, and finalised in February 2012.	Not included as item is complete.
		The analysis is currently being undertaken and will consider management scenarios for DEWHA approval and will produce preliminary results		June 2010		The PVA was peer reviewed by a quantitative ecologist and the review has been attached to the final PVA report.	
		Peer review of PVA and update of PVA.		early 2011		See Section 4.6	
		Further updates of PVA will be undertaken as necessary, particularly during formal review of bandicoot plan		Formal reviews: 2011, 2012, 2015 & 2020			
2(e)	Discuss a range of options for offsets in the event that the SBB population in the Pines Reserve continues to decline, including the last resort option of translocation.	Offsets to be identified after completion of pre-construction and during construction monitoring and incorporated into plan.	Section 6.4.2	Formal review 2012.	LMA, Parks Victoria and DEPI	See section 6.3.2 for further discussion on alternative strategy	Section 8.7 See section 6.3.2 for further discussion on alternative strategy

EPBC Condition	Condition Details	Deliverable	Reference in SBB Management Plan (March 2010)	Timing SBB Management Plan (March 2010)	Responsibility	Compliance Status at January 2014	Reference in SBB Management Plan January 2014
2(f)	Arrangements to fund the implementation of the plan.	Pre-construction and during construction phase	Section 2.4.1		LMA	Funding to implement the 2014 SBB Management Plan has been addressed in Section 7.3.	Section 7.3
	Arrangements to fund the implementation of the plan.	Post construction phase			LMA to facilitate		
2(g)	Schedule of proposed works, timings and responsibilities		Section 3.6 Section 4.9 Section 5.6 Section 6.5 Section 2.2				Sections 7.2, 9
2(h)	Review the opportunities for maintenance and creation of corridors for the SBB to enhance the connectivity of habitat in the region.	Plan detailing connectivity of habitat initiatives in the region	Section 6.3		DEPI and local Councils.	Sections 4.5.4 and 5 address the review of opportunities for habitat connectivity.	Section 5.6 & 5.7
2(i)	A description of its objectives, performance criteria and corrective actions as well as provisions to review the plan regularly.		Section 2.3 & 2.4			Review completed as proposed in first version of the plan	Section 7

3 Pines Flora and Fauna Reserve

3.1 Description

The Pines FFR is a 240 hectare area containing significant remnants of heathy woodland and heathland vegetation and is located approximately 40 km south east of Melbourne and 3 km north east of the Frankston Central Business District on the Mornington Peninsula. It was established in 1989 as a 108 hectare reserve and was expanded to its present size in 2006. The Pines FFR is located within the Gippsland Plains Bioregion.

The reserve is located within an urbanised environment surrounded by residential properties, Ballarto Road, Tamarisk Drive, McClelland Drive, the Peninsula Country Golf Club and the Centenary Golf Course. The reserve is a Biosite of State significance and provides habitat for species protected under the *Environmental Protection and Biodiversity Conservation Act 1999* (Commonwealth) (EPBC Act) and the *Flora and Fauna Guarantee Act 1988* (Victoria).

The Ecological Vegetation Classes (EVCs) within the Pines FFR are regionally endangered and are of High Conservation Significance under the Native Vegetation Framework (NRE 2002). A number of National and State significant flora species have also been recorded at the reserve, including River Swamp Wallaby-grass (*Amphibromus fluitans*). Other National and State significant fauna species recorded at the reserve include Dwarf Galaxias (*Galaxias pusilla*) and Swamp Skink (*Egernia coventryi*).

The Pines FFR and surrounding lands represent an important core habitat patch including heathy woodland and historic sites for the SBB (Biosphere, 2006). Although SBBs once occurred in the wider Frankston area and were considered common (pre-1970s), records indicate that the Pines FFR recently had one of the last confirmed populations of SBB on the Mornington Peninsula.

The immediate landscape surrounding the Pines FFR has rapidly become urbanised. Without effective management, any existing SBB population at the Pines FFR will further decline and may face localised extinction (Coates et al., 2008).

Parks Victoria is responsible for the management of the Pines FFR, which includes the former Department of Agriculture and Rural Affairs (DARA) land and also includes a section of the former KTRI site. An additional part of the former KTRI site is shown in figure 2 is to be incorporated into the Pines FFR to offset some of the land losses from Peninsula Link.

3.2 Sub-regional context

Residential areas occur to the south, west and north of Ballarto Road (**Figure 2**). The Peninsula Country Golf Club abuts the south-west boundary and Centenary Park Public Golf Course abuts the Pines FFR in the south-east. The Pines FFR is one of several significant open spaces in the south-eastern suburbs of Melbourne. Other nearby open space areas include the Seaford Wetlands to the north, Langwarrin Flora and Fauna Reserve (Langwarrin FFR) and Frankston Natural Features Reserve (or Frankston Reservoir) to the south, and the Royal Cranbourne Botanical Gardens to the east (LMA, 2010).

In a subregional context, the Pines FFR falls within the more urbanised western half of the sub-region which constitutes a mote hostile landscape matrix for SBB by supporting potentially higher densities of foxes and other predators (e.g. cats), higher traffic volumes and a more resistant landscape matrix for faunal movement (Practical Ecology 2011).

The former KTRI land, managed by the DEPI, is located centrally along the northern boundary which, along with the Centenary Park Public Golf Course to the south, creates a pinch-point in the central area of the Pines FFR and a significant division between the two major parcels comprising the Pines FFR. The Peninsula Link alignment, running from the north-west to the south-east, further bisects the Pines FFR and emphasises the sense of fragmentation (LMA2010)._

Figure 2 - Land use surrounding The FFR

3.3 Management of the Pines Flora and Fauna Reserve

A Master Plan for the Greater Pines Reserve (LMA, 2010) (see: *http://www.linkingmelbourne.vic.gov.au/downloads/ees/12_FBTV1_06part1.pdf*) has been prepared and approved. Parks Victoria manages the reserve in accordance with this plan as well as a range of other general strategies, plans and operational policies and guidelines. Future management of the Pines FFR will be in accordance with a Management Statement which will be prepared in 2014/15 by Parks Victoria. The preparation of the Management Statement, which is in accordance with the Conservation Reserves Management Strategy (Parks Victoria, 2003), will outline management aims and goals for the reserve's natural values, cultural values and visitor facilities for the short to long term. Management will reflect that the reserve is both an important conservation area and a community asset for recreation. This management statement will be prepared after this management plan is finalised and approved.

Parks Victoria is committed to providing places for people to enjoy time in nature, to be active and to interact with others in the community. Parks Victoria's core philosophy *Healthy Parks Healthy People* expresses the strong link between community health and access to nature. The reserve provides for recreational experiences including walking, nature appreciation, picnicking, cycling and on-leash dog walking.

In the face of predicted increased recreational use of the reserve, the Master Plan for the Greater Pines Reserve provides direction for a focus of recreational use to be in more modified environs with dispersed lower impact activities (e.g. walking and nature appreciation) focussed in the "core conservation areas" comprising important fauna habitat. This approach aims to achieve a balance between the reserve's conservation and recreation roles.

4 Status of the Southern Brown Bandicoot in the Pines Flora and Fauna Reserve

This section describes:

- the conservation status of the SBB
- its habitat requirements
- its distribution
- its conservation status in the Pines FFR
- threats in the Pines FFR
- connectivity requirements
- population viability in the Pines FFR
- issues associated with any potential reintroduction program of SBB into the Pines FFR.

4.1 Conservation status of the Southern Brown Bandicoot

The SBB (*Isoodon obesulus*) is a medium sized, ground dwelling marsupial native to southern, eastern and south-western Australia. Different subspecies are recognised across its range, with an eastern (*Isoodon obesulus obesulus*) and western (*Isoodon obesulus fusciventer*) form described. Unless otherwise noted, all references to SBBs in this management plan relate to the eastern subspecies, *Isoodon obesulus obesulus*, at the Pines FFR.

Once common across its mainland range, the SBB has rapidly declined and is now restricted to isolated remnant habitat patches. The animal is characterised by a long pointed snout, small rounded eyes and coarse brown/grey fur.

The SBB is now considered in danger of extinction throughout south-eastern mainland Australia and has been subsequently listed as “Endangered” under the EPBC Act. The subspecies is also listed as “Threatened” under the Victorian *Flora and Fauna Guarantee Act 1988* (Department of Sustainability and Environment (DSE), 2011).

4.2 Habitat requirements of the Southern Brown Bandicoot

The SBB occurs naturally in heathland, heathy woodland and shrubland communities over southern Australia (Brougham & Dickman, 1991 and Coates et al., 2008). The species associates with sandy and well drained soils like those occurring at the Pines FFR, where it preferentially forages on relatively infertile soils (Haby & Long, 2005).

SBBs readily associate with areas of dense ground vegetation across a range of habitats. Areas of dense cover and ground vegetation are pivotal to their habitat choice. SBBs forage for insects and fungi and construct shelter/nests out of leaf litter and loose soil. Bandicoots aerate soil with their distinct conical shaped diggings and spread fungi that fertilise and recycle nutrients.

In degraded and altered landscapes, the SBB is known to utilise vegetation along abandoned rail lines, roads and weed infested drainage lines.

4.3 Distribution of the Southern Brown Bandicoot in surrounding area

There have been many historical SBB sightings in the greater Frankston area (Coates et al. 2008). Most records occur in or around large patches of remnant heathy woodland in Frankston, Langwarrin and Cranbourne (e.g. conservation reserves, golf courses, privately owned bush blocks and small council reserves).

The SBB population has rapidly declined in recent years across the south-eastern suburbs and Mornington Peninsula, including at the Pines FFR. SBBs have not been recorded at Langwarrin FFR since the 1980s. Presently there are only two known populations within 15 km of the Pines FFR, namely the Royal Botanic Gardens Cranbourne (RBGC) and at Quail Island in Western Port Bay, directly west of Warneet. The population at RBGC is the only population in the greater Melbourne area large enough and managed appropriately to be considered secure. A sizeable population also occurs on Quail Island and there is significant potential to protect this population and provide for dispersal into adjacent habitats.

4.4 Southern Brown Bandicoot in the Pines Flora and Fauna Reserve

The SBB was reportedly common throughout the Mornington Peninsula and Melbourne in the 1800s. However, by the second half of the twentieth century the Victorian population was in decline (Coates et al., 2008). The SBB was known to exist at some sites in the Melbourne region until relatively recently but, during the last 30 years, it is likely that many of these persisting populations are, at the least, functionally extinct.

SBBs and signs of its presence (e.g. scats and characteristic diggings) were once common at the Pines FFR. A 2006 survey of the Pines FFR and DARA land identified 18 SBB diggings and scats (Biosis Research, 2008). This survey demonstrated the continuing presence of the SBB at the reserve, albeit in a very low abundance.

The SBB population within the Pines FFR is thought to have declined considerably in the last decade and if current trends continue, faces extinction in the near future (Coates et al. 2008).

Evidence of the SBB was found within the Pines FFR during the EES field surveys (diggings and a hair sample collected). However, the population was considered to be small (Biosis Research 2008).

Monitoring was undertaken within the Pines FFR and control sites within the region prior to the commencement of construction and during the construction of Peninsula Link. Monitoring has indicated that a small population persists within the Pines FFR as identified by two hair samples and potential diggings (**Table 2**). No SBBs have been detected using infrared cameras.

Table 2 - SBB monitoring results undertaken within the Pines FFR for the Peninsula Link Project

Phase	Number of survey sites at the Pines FFR	SBB Detection (The Pines FFR)
Pre-Construction		
Spring 2009	45	-
Summer 2009	49	1 hair, potential diggings
Autumn 2010	76	potential diggings
Construction		
Spring 2010	75	1 hair, potential diggings
Spring 2011	77	potential diggings
Spring 2012	74*	potential diggings

*A total of 72 plots surveyed followed by 10 cameras at two sites (5 per site) where potential diggings were found during active searching.

Based on the monitoring results to date the current population of SBB in the Pines FFR is likely to comprise only a few individuals or be locally extinct.

4.5 Threats in the Pines Flora and Fauna Reserve

Nationally, the major threats affecting SBB populations include habitat loss or modification, inappropriate fire regimes, introduced predators, and loss of connectivity among patches of habitat (Brown and Main 2010). At the Pines FFR, the major threats to SBB persistence are thought to include fox predation, cat predation, road mortality and inappropriate fire regimes. The relative immediate importance of connectivity to surrounding habitat patches and habitat loss within the Pines FFR compared to these threats are unknown but is also likely to be important (ARCUE, 2012a).

Since the late 1980s, Parks Victoria has given an emphasis to management aimed at improving fauna habitat and vegetation condition in the Pine FFR and the majority of the Ecological Vegetation Communities (EVCs) in the Pines FFR were assessed as being in high condition by Biosis Research in 2008. Enhancement work has entailed the removal of pine plantations, pest plant control, ecological burning to control invasive woody weeds, closure and revegetation of tracks, revegetation with the assistance of the Friends Group and other volunteers and periodic pest animal control.

There are a number of threats to SBB in the Pines FFR which are exacerbated by the Pines FFR's location in an urbanised environment. Key threats at the Pines FFR include:

- Predators and pest animals
- Road mortality as the reserve is bounded by a number of busy roads
- Fire
- Connectivity to other habitat
- Inappropriate human activities such as arson, vandalism of fences, gates and other infrastructure, trail bike riding, allowing dogs off leash and dumping of cars and rubbish.
- Degraded habitat.

4.5.1 Predators and pest animals

The European Red Fox (*Vulpes vulpes*) is a carnivorous mammal that has been introduced and established in Australia (Menkhorst, 1995). Many small ground dwelling native species are currently threatened and endangered in Australia. Predation by foxes is considered a major factor driving these species towards extinction (Menkhorst, 1995).

Both cats and foxes are versatile and have adapted extremely well to Australia's modified landscapes (Poole and McKillop 2002; Coates 2008). Predation by foxes is considered a major reason for the decline in abundance and distribution of SBBs within the Pines FFR and more broadly across the landscape. Cats are considered as major predators of native wildlife and a threat to bandicoot population viability (Practical Ecology 2011).

Foxes occur across the landscape in the area surrounding the Pines FFR. However the potential for effective and relatively cost efficient broad scale fox control is expected to be significantly higher in the rural area when compared to urban areas. Fox control undertaken by LMA over the past five years in the Pines FFR has reduced fox numbers for periods, however due to relatively high numbers of foxes in the surrounding urban areas and major limitations on broad-scale fox control there will be persistent risks of fox predation at the Pines FFR at variable levels into the future.

Integrated pest animal control is considered to be important and is intended to be continued into the foreseeable future to aim to reduce the impacts of foxes, cats and rabbits. Rabbit control is important to protect revegetation activities and natural regeneration of vegetation. Fox control needs to continue to reduce predation of fauna, particularly if rabbits are controlled to low numbers which would remove a food source for the foxes

Previous monitoring and control work suggest that the fox population at the Pines FFR exists at a very high density (ARCUE, 2011). Sandpad surveys have been undertaken within the Pines FFR to detect fox activity, with the number of fox footprints at each sandpad recorded before and after fox eradication programs and compared to assess the impact on fox activity.

The 2011 sandpad survey suggests the fox control program successfully had an impact on fox activity at the Pines FFR in the short term. However the sandpad survey also indicates foxes began to rapidly increase activity and re-invade areas after the fox control programs finished (ARCUE, 2011).

Several predator control programs have been undertaken within the Pines FFR, with mixed results. Parks Victoria initiated predator control programs within the Pines FFR including a fox trapping program in May 2007, which resulted in seven fox captures. In 2008, the program was extended into adjacent areas through support of neighbouring property managers including DPI, FCC and the Peninsula Country Golf Course and resulted in 14 fox captures (of which two were caught in the Reserve). A further 14 foxes were controlled within the reserve in late 2009 and early 2010.

LMA has also implemented a fox control program in accordance with The Southern Brown Bandicoot Management Plan: Pines Flora and Fauna Reserve, March 2010. This included 30 nights of soft-jaw trapping annually since 2009 during February – April. Results are shown in **Table 3**.

Table 3 – Pest Animal Control results undertaken within the Pines FFR for the Peninsula Link Project

Time Period	Control method	Results
Sep-Dec 2009 (30 Nights)	Fox Trapping Den fumigation	12 foxes 3 cats
Feb-March 2010 (38 Nights)	Fox Trapping Den fumigation Rabbit control	2 foxes 5 cats
March –May 2011 (32 Nights)	1080 Poisoning Fox Trapping Den fumigation Rabbit control	14 foxes 3 cats
March – April 2012	Fox Trapping Den fumigation Rabbit control	13 foxes 1 cat
May 2013	Fox Trapping Den fumigation Rabbit control	4 foxes

Lethal baiting in the Pines FFR was undertaken during 2011, but the use of 1080 baits was restricted due to the risks posed to domestic pets as well as the risks of baits being moved by foxes into surrounding residential areas. Furthermore, a total of only three baits were taken by foxes and the benefit of undertaking future baiting programs is questionable, given the intensity of monitoring and resourcing required.

Even though the predator control measures resulted in some fox captures, Parks Victoria considers that attempts to eradicate foxes within the Pines FFR would have a very low potential for success due to constraints on predator control techniques (1080 poison baiting) and high risks of significant on-going immigration, particularly given the likelihood that there is expected to be a high fox population within the surrounding area, typical of urban fringe areas.

The European Rabbit also poses a significant threat by degrading SBB habitat and being a food source for exotic predators. Rabbits are known to prevent regeneration of understorey vegetation, contribution to erosion and soil disturbance and thereby facilitate environmental weed invasion (Practical Ecology 2011).

Rabbits occur primarily within areas of the Pines FFR that have been subject to previous disturbance associated with past land use (e.g. horticulture and pest animal research) including the area of the former KTRI which has been added to the Reserve. Rabbits pose a threat to both revegetation and natural regeneration of habitat and the 16 ha revegetation area (section 4.5.6) has been fenced to exclude rabbits. Periodic rabbit control has occurred in the past and has been intensified over the past three years through a baiting program which commenced in 2009/10. Rabbit numbers have been significantly reduced as a consequence of the recent control with an estimated 70% population reduction in 2011.

Recent spotlight survey indicated that low numbers of rabbits persist. Subject to funding, on-going control is proposed in order to enhance protection of priority restoration areas.

4.5.2 Road mortality

No SBBs are expected to be found along Peninsula Link roadway within the Pines FFR. The roadway through the Pines FFR is constructed predominantly on elevated sections of retaining walls (Refer to Plate 1). The road design includes barriers to prevent fauna from entering the road area. There are also fauna underpasses which will allow fauna to cross under Peninsula Link at numerous locations.

There are light spill walls along both sides of the roadway within the Pines FFR which will prevent fauna accessing the carriageway.

Plate 1 – Retaining walls in Pines FFR

4.5.3 Fire

While fire risks occur across the broader landscape, relatively few fires have historically occurred within the rural part of the sub-region when compared to the urban area and urban fringe (Southern Metropolitan Regional Strategic Fire Management Committee 2011).

The Pines FFR is within the urban fringe and has had a high incidence of fire and a major portion of the reserve has been burnt over the past 20 years. The majority of fires have been deliberately lit through arsonist activity with four fires exceeding 50 hectares in area during the period from 1987 to 2004, all within the western portion of the reserve, which largely comprises suitable SBB habitat in high condition (as assessed by Biosis Research in 2008).

Data recently collected by DSE on the historical location of all fire ignition points within the South East Metro Region highlights that the Pines FFR is among several locations with the highest number of fire ignitions. The Pines FFR may therefore have an on-going history of inappropriate fire due to potential arson activity. Fire impacts (including risks of larger fires) are expected to increase into the future with the effects of climate change.

The Fire Management Plan for the Southern Metropolitan Region (2011) identifies that there are significant opportunities to integrate and coordinate anti-bushfire arson strategies undertaken by the police with those activities undertaken by fire agencies (Country Fire Authority/DSE/Parks Victoria) and other land managers, particularly in relation to patrol of high risk areas during high risk times. This coordination, along with police-led programs for community awareness and participation in prevention programs will hopefully reduce arson activity in the Pines FFR. However, the potential for significant fire events in a small reserve with minimal habitat connectivity still needs to be considered in assessing risks to the SBB.

Fire management in the reserve will continue to give priority to the protection of human life and property and aim for ecologically appropriate fire regimes to maintain the reserve's natural ecosystems.

4.5.4 Connectivity

The vegetation within the Pines FFR is of state significance and the area supports known and previously known nationally listed flora and fauna species. The Peninsula Link project has incorporated a range of measures to reduce impacts to these sensitive vegetation and fauna habitats. Within the Pines FFR, the project includes a major fauna underpass which incorporates two spans measuring 30 metres in width and five metres in height. The underpass also allows a creek to flow across Peninsula Link. The open span design and light-wells in the median ensure that light filters through and that habitat connectivity is supported for a variety of fauna species including birds, reptiles, small mammals, fish and frogs (see Plate 2).

Plate 2 – Major fauna underpass (June 2012)

In addition to the major fauna underpass, a series of culverts (2m x 2m) on either side of the underpass are provided. In total four culverts have been provided which cater for fauna movement. There are two further drainage crossings of Peninsula Link which provide extra connectivity in the area. The four culverts have been fitted out with fauna furniture to entice fauna to use the crossings (See Plate 3).

Plate 3 – Fauna furniture inside culvert

Within the Pines FFR past land use (e.g. pest animal research, horticulture and agriculture research) and associated vegetation clearance has resulted in modified and disturbed landscapes and a lack of remnant vegetation connectivity between the remnant EVCs in the western and eastern portions of the reserve. Much of this disturbed area is dominated by woody weeds and pasture grasses and parts are currently subject to revegetation and weed control works (section 4.5.6).

Increased fragmentation, subdivision, urban development and road construction is progressing quickly in the south-eastern region of greater Melbourne. If appropriate ecological connections are not considered in current planning processes then the opportunity to re-establish the SBB populations will be lost as the landscape continues to be developed. The consequence of not incorporating habitat links into Precinct Structure Plans within the current and proposed Urban Growth Boundary (UGB) will result in the permanent isolation of ecological assets such as the RBGC. The ecological impacts include a likely increase in the vulnerability of populations of flora and fauna to decline and extinction, in particular the nationally endangered and highly significant SBB.

The Pines FFR is effectively an island within outer metropolitan Melbourne and is generally isolated from other significant habitat remnants. Further isolation is expected through additional development in the area. As mentioned above, planning processes need to consider appropriate ecological connections when approving developments and there is limited opportunity for the Pines FFR to be ecologically connected due to the surrounding land use. Planning has been initiated by the Frankston City Council to investigate opportunities for enhanced fauna connectivity within the municipality. This was scheduled to be completed by early December 2012, however the report to date has not been publicly released.

4.5.5 Inappropriate human activities

The Pines FFR is currently subject to a relatively high level of inappropriate human activities including arson, vandalism of fences, gates and other infrastructure, trail bike riding, allowing dogs off leash and dumping of cars and rubbish.

The approved Master Plan for the Pines FFR provides for improved visitor access and facilities and there are plans for a Peninsula Link Trail along the boundary and other highly modified areas in the reserve. With increased accessibility more people from the local community are expected to become aware of the reserve itself and the important conservation and recreation values it provides.

Raising community awareness is particularly important to foster enhanced support for park management, to influence community attitudes and seek to change behaviours with the aim of increasing community participation in management. The presence of more people in the reserve will hopefully assist ranger efforts to reduce the current level of inappropriate activities.

When the Management Statement is approved and the Pines FFR is added to the Schedule to the *Crown Land (Reserves) (Nature Conservation Reserve) Regulations 2004* (VIC), rangers will be able to improve behaviours over time through a combination of compliance action (e.g. issue penalty infringement notices) and community education.

4.5.6 Degraded Habitat

Weeds pose a significant challenge to programs for restoration and/or enhancement of the Ecological Vegetation Communities (EVCs) present at the Pines FFR because of persisting weeds. The reserve area has grown considerably over the past 15 years, with the addition of more than 120 ha of adjacent Crown land areas that have varying degrees of modification due to past land use and vegetation clearance. Further modified areas are scheduled to be added to the Pines FFR area posing additional resourcing pressures.

While Peninsula Link has impacted on the EVCs within the Pines FFR, this impact is being partially offset by revegetating 16 ha of former orchards to suitable SBB habitat through the approved Pines FFR Revegetation Plan for the former orchard site (see: http://www.linkingmelbourne.vic.gov.au/pages/revegetation-program.asp). This revegetation aims to restore original EVCs cleared through past land use and is expected to contribute significantly to achieving environmental objectives in the longer term.

The remainder of the native vegetation offset will be sourced through retention, protection and management of remnant native vegetation elsewhere in the Gippsland Plain bioregion.

In addition, implementation of a five year weed control program funded by LMA has commenced to support works being undertaken by Parks Victoria. These works give priority to re-establishing enhanced habitat connectivity within the reserve for the benefit of fauna.

Management over the short to long term will continue to focus on habitat enhancement or restoration specifically aimed at maintaining the condition of those EVCs in high condition and progressively improving the condition of EVCs in low to moderate condition.

4.6 Population viability analysis

In accordance with Condition 2(d) of the EPBC approval for Peninsula Link, a population viability analysis (PVA) was undertaken for the SBB at the Pines FFR (ARCUE, 2012a). PVA is a population simulation tool used to calculate the risk of extinction for a population within a particular period of time, and to compare the predicted relative outcomes of a range of management measures.

The aim of the PVA was to assess the effect of potential management measures and recovery actions on the viability of the SBB population in the Pines FFR.

PVA involves identification of management scenarios to be modelled, then quantifies the various demographic and landscape data necessary to represent scenarios. This is done by building a set of 'current scenario' parameters, then altering them to represent management scenarios. When the scenarios are compiled, the PVA simulations are run to produce various results (expected minimum population size, mean end population, and interval extinction risk). A sensitivity analysis is also performed to explore how much individual parameters (e.g. dispersal distance) affect model outputs. The data is then evaluated and ranked to assist with the decision-making processes (ARCUE, 2012a).

A series of management scenarios were modelled by ARCUE and included the following:

- The current management scenario
- Peninsula Link acting as a complete barrier to SBB dispersal
- Connectivity corridor to another area of habitat
- Various fire regimes
- Community awareness campaign
- Predator control
- Predator proof fence around the perimeter of the Pines FFR
- 50 hectare and 10 hectare predator proof enclosures
- Various combinations of the above scenarios.

It should be noted that the PVA did not consider the feasibility of implementing the management scenarios. For example, the connectivity corridor assumed that a habitat corridor could be established between the Pines FFR and the Langwarrin FFR. The PVA noted that, in reality, this corridor is not feasible due to major roads and urban infrastructure. The PVA modelled this scenario to identify if connectivity is a key issue for the viability of SBB at the Pines FFR.

Under the current management scenario, the starting population was set at 10 SBB, for the purposes of the PVA. This estimated PVA starting population is most likely greater than the current existing population of SBB in the Pines FFR. After 100 years, this scenario had:

- a expected minimum population of 0.4 SBB
- a mean end population size of 3 SBB
- 95 per cent chance of the population reaching 4 individuals or fewer
- 89 per cent chance of extinction (<1 individual) over the next 100 years (ARCUE, 2012a).

Therefore, even with other management actions, translocation (population reintroduction) would be required to supplement the existing population until it is large enough to withstand threatening processes (ARCUE, 2012a).

Result showed that without some direct management intervention, the population of SBB of the Pines FFR is highly likely to become extinct within the next 100 years.

The PVA found that a lack of adequate predator control and habitat management at the Pines FFR is very likely to cause the extinction of the SBB from the Pines FFR. The scenarios with the greatest influence on population viability were those that incorporated a full perimeter or 50 hectare predator-proof fence. There is a well-maintained predator proof fence around the RBGC. The PVA assumed that the same management techniques would be applied within a fenced area at the Pines FFR as are applied at the RBGC. In turn, this would lead to improved habitat quality.

All other scenarios, when modelled in isolation, had little effect on improving the viability of SBB across the time period modelled (ARCUE 2012a).

All scenarios with the addition of a well maintained, predator-proof fence around the perimeter of the reserve improved the viability of SBB at the Pines FFR. The most effective scenario (fencing Langwarrin FFR, 80 per cent reduction in predators, a perimeter fence and assumed connectivity to the Langwarrin FFR) provided model results of:

- a expected minimum population of 130.7 SBB
- a mean end population size of 975.2 SBB
- 95 per cent chance of the population reaching 155 individuals or fewer
- <0.001 per cent chance of extinction (<1 individual) over the next 100 years (ARCUE, 2012a).

As noted above, it is not feasible to connect the Pines FFR with Langwarrin FFR due to major roads and urban infrastructure without major project resource commitment by the State Government.

The feasibility of building and maintaining a predator-proof fence at the Pines FFR must also be considered when determining the likely viability of the SBB population. The PVA assumes that a fence is feasible and that it is well maintained so that it continues to be effective in the management of the SBB population. Without sufficient management of the fence, predator control measures and ongoing resource commitment for these activities, the viability of the SBB population within the fenced area would be reduced.

4.7 Population reintroduction

Breeding programs and fauna species translocation are measures that are sometimes used to attempt to increase population numbers for an individual species that is near to extinction. Fundamental biological studies are required prior to assessing the feasibility of a breeding program or species translocations (Practical Ecology, 2010).

A literature review on the issues associated with translocation of fauna was prepared by Rodney van der Ree (ARCUE; RBGC) for Practical Ecology (2010) which highlighted the complexities of translocations, including:

- A clear goal of translocation is required, and an effective management and monitoring plan
- Translocation may be costly, and carries risks of injury, disease transmission and behavioural disruption when individuals are released
- Relocations are often carried out in an ad hoc fashion and not carefully monitored
- Translocation needs to be rigorously planned and evaluated against alternative conservation strategies
- Managing gene flow comprises considerable complexity in order to maintain genetic viability in the context of other management constraints. Issues to be addressed include: which individuals to translocate, how many, how often, from where to where, when should translocations begin and when should they stop
- A number of factors affect post-release success dramatically, including number of animals released together, their kin relationships and/or level of familiarity with one another.

As outlined in Section 4.6, translocation of SBB would be required to ensure that the existing population is large enough to withstand threatening processes. However, no translocations should be considered until the major threats and risks at the Pines FFR can be controlled to a level that would allow the SBB population to remain viable. The number and source of these animals for translocation, the frequency of supplementation and the monitoring of the population must be carefully considered prior to commencing a translocation program (ARCUE, 2012a).

It is important to note that LMA does not have the capacity or authority within the State of Victoria to source animals or conduct translocations. Any reintroduction program would need to be conducted under the supervision and authority of the DEPI.

4.8 Summary of SBB status and management implications

The SBB population in the Pines FFR has rapidly declined in recent years and is likely to consist of only a few individuals or may be locally extinct. The Pines FFR is both an important conservation area and a community asset for recreation. It will continue to be managed for multiple uses. The key threats to SBB persistence in the Pines FFR are thought to include predation and inappropriate fire regimes. Connectivity to surrounding habitat patches and habitat loss within the Pines FFR are also likely to be important factors in the survival of the SBB population.

While there is ongoing predator control within the Pines FFR, due to relatively high numbers of foxes in urban areas, and limitations on broad-scale control, there will be persistent risks of fox predation at variable levels into the future.

The Pines FFR has had a high incidence of fire and a major portion of the reserve has been burnt over the past 20 years. The majority of fires have been deliberately lit through arsonist activity and the Pines FFR may continue to have inappropriate fires due to potential arson activity. The potential for significant fire events in a small reserve with minimal habitat connectivity needs to be considered in assessing risks to the SBB population

Connectivity under Peninsula Link is maintained by the provision of a major underpass and number of culverts with further opportunities for connectivity provided through drainage crossings and the emergency vehicle underpass.

The Pines FFR is effectively an island within outer metropolitan Melbourne and is generally isolated from other significant habitat remnants. Further isolation is expected through additional development in the area. Planning processes need to consider appropriate ecological connections when approving developments and there is limited opportunity for the Pines FFR to be ecologically connected due to the surrounding land use. Planning has been initiated by the Frankston City Council to investigate opportunities for enhanced fauna connectivity within the municipality and was due for completion by early December 2012, however the report to date has not been publicly released.

The Pines FFR is currently subject to a high level of inappropriate activities including arson, vandalism of fences, gates and other infrastructure, trail bike riding, allowing dogs off leash and dumping of cars and rubbish. These threats have potential to impact on the viability of the SBB population particularly fence and gate vandalism and arson activity.

The PVA showed that, without some direct management interventions, the population of SBB at the Pines FFR is highly likely to become extinct within the next 100 years. Lack of adequate predator control and habitat management at the Pines FFR is very likely to cause the extinction of the SBB from the Pines FFR. All scenarios with the addition of a well maintained, predator-proof fence around the perimeter of the reserve or a smaller enclosure greatly improved the viability of SBB at the Pines FFR. However, the feasibility of building and maintaining a predator-proof fence at the Pines FFR must also be considered. The PVA assumes that the fence is well maintained so that it continues to be effective. Without sufficient management and predator control, the viability of the population within the fenced area would be greatly reduced.

When combined with the results of the current monitoring program indicating that the population of SBB may in fact be locally extinct in the Pines FFR and even with other management actions, reintroduction of SBB into the Pines FFR may be the only way to initiate recovery within the reserve. Population reintroduction would be required to supplement any existing population until it is large enough to withstand threatening processes. However, no translocations should be considered until the major risks or threats at the Pines FFR can, if feasible, be controlled to a level that would allow the SBB population to remain viable and self-sustaining. The number and source of these animals for translocation, the frequency of supplementation and the monitoring of the population must be carefully considered prior to commencing a translocation program.

It is important to note that LMA does not have the capacity or authority within the State of Victoria to source animals or conduct translocations. Any reintroduction program would need to be conducted under the supervision and authority of the DEPI.

The key management implications for the SBB population are the feasibility, or otherwise, of a predator proof fence and the feasibility of mitigation of key threats over the long-term. The feasibility of a fence is discussed further in Section 6.1.

5 Strategic and policy context

The discussion of strategy and policy below is intended to provide context for the management implications identified above in Section 4.8. It considers:

- National Recovery Plan
- Regional Recovery Plan
- Flora and Fauna Guarantee Act
- Sub-regional Species Strategy
- Ecological Connectivity Plan
- Creating Fauna Linkages and Structure Designs
- Ecological Character Description.

Other plans that are in the process of being developed but have not yet been released include the National Southern Brown Bandicoot Recovery Plan and Port Philip Westernport Catchment Management Authority 2010-2016 Regional Catchment Strategy.

5.1 National Recovery Plan

A Draft National Recovery Plan for the SBB (Brown and Main 2010) has been developed as a requirement of the EPBC Act. Originally published in 2004, a revised draft was released for public comment in June 2010 and is currently awaiting finalisation.

5.2 Draft Regional Recovery Plan

The draft Regional Recovery Plan for the SBB (Nicholls & Coates, 2011) is intended to translate the recommendations of the draft National Recovery Plan to the area of interest for the Western Port Biosphere Reserve Foundation ('the Biosphere') in south-central Victoria, and provide a plan of action for the Biosphere to implement these recommendations. It provides nine objectives for management, as well as specific actions.

Objective four is to identify threats and implement management practices to assist in the recovery of the species. Specific actions include:

- Ensure fire management activities consider the conservation requirements of the SBB
- Implement effective control and monitoring methods for introduced predators
- Evaluate the impacts of weed invasion and develop a protocol for managing weeds
- Control (or at least reduce) threats from road mortality
- Improve the control of companion animals, particularly dogs and cats.

Biosphere Action 4.1.2 identifies 'Tackle loss of connectivity between the remaining habitats'. However, it does not provide specific actions to achieve this.

Objective 6 commented on the need to assess the requirement for captive populations. The draft Regional Recovery Plan commented that translocation of the SBB would first require a captive breeding program to be developed. It noted that that there are currently no plans to develop a captive breeding programme as a source of animals for re-introduction to the wild, though such a programme has potential in NSW (where SBB populations are particularly threatened) if the sub-populations there decline further (Nicholls & Coates, 2011). The draft Regional Recovery Plan also advises that it is wise to determine the requirement and the timeframe for implementing such a strategy as it would require local SBB to first be captured, held and bred (Nicholls & Coates, 2011). The draft Regional Recovery Plan notes that SBB (including SBB in Victoria) should only be bred in captivity and released, or otherwise translocated, where the SBB are likely to survive in the short and long term. For the reasons set out in Section 4.5, the Pines FFR is not considered likely to support the survival of SBB in the short and long term.

The draft Regional Recovery Plan also acknowledges that translocations are contentious; however, it notes that reconnecting isolated populations and restocking reserves that have suffered local extinctions, including the Pines FFR, needs investigation. The legality, methods, source and destination of translocated animals – as well as preparatory and ongoing management – all need to be explored. The genetic structure of the extant populations should be determined. The success of fox control and the effect of pest predators must be determined. Discussion on the viability of translocations with scientists, managers and the broader community is needed (Nicholls & Coates, 2011). SBB release or translocation to the Pines FFR has been specifically considered in this SBB Management Plan and, in particular, is considered in Section 6.3.1.

5.3 Flora and Fauna Guarantee Act 1988

The *Flora and Fauna Guarantee Act 1988* provides for the listing of Victoria's threatened plant and animal species, ecological communities and potentially threatening processes. Under the Act, an Action Statement must be prepared by the Department of Environment and Primary Industries for each item following its listing. DEPI has also developed the Actions for Biodiversity Conservation (ABC) system in which the actions in Action Statements are stored. Responsibility for undertaking actions is recorded and priorities for action set. This system also allows DEPI to monitor the implementation of Action Statements and actions being undertaken for threatened species recovery when no Action Statement is present. The Action Statement for the Southern Brown Bandicoot is under preparation.

The Actions for Biodiversity Conservation (ABC) is a web-based information system developed and implemented by DEPI. It is the primary means by which DEPI accumulates knowledge about threatened species and communities in Victoria. It is used to track the progress of management actions documented in Action Statements prepared under the Flora and Fauna Guarantee Act 1988 and in Recovery Plans prepared under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999. The key actions associated with the recovery of the Southern Brown Bandicoot held in the ABC are listed below:

1. Prepare, implement and review site management plans for all priority sites
2. Involve community groups and volunteers in recovery activities
3. Develop, publish and distribute educational, technical or publicity material and/or displays.
4. Manage environmental weeds and introduced predators
5. Erect/maintain fences to exclude introduced animals or control access in priority sites
6. Prevent habitat fragmentation
7. Liaise with private landholders
8. Develop detailed population monitoring protocols

9. Undertake population modelling and/or viability analysis
10. Conduct survey to confirm existing records
11. Conduct survey to determine abundance/extent
12. Conduct survey to locate additional populations
13. Identify fire management priorities and develop detailed plan
14. Maintain vegetation structure
15. Provide input into regional fire management and operations plans
16. Liaise with stakeholder groups
17. Develop, provide input to or implement park, reserve or land management plan
18. Undertake research into management requirements

5.4 Sub-regional Species Strategy

The Sub-regional Species Strategy (Strategy) for the SBB has been prepared in response to obligations arising from the Melbourne Strategic Assessment conducted under Part 10 of the EPBC Act (DSE 2011) (see http://www.depi.vic.gov.au/__data/assets/pdf_file/0005/251366/Southern-Brown-Bandicoot-Sub-regional-Species-Strategy-Jan-2014-FINAL-webA3.pdf).

The Melbourne Strategic Assessment evaluated the impacts of the Victorian Government's Program 'Delivering Melbourne's newest sustainable communities' on matters of national environmental significance listed under the EPBC Act. The Program provides for urban development in four growth areas within Melbourne's expanded 2010 UGB and in 28 existing precincts within the 2005 UGB.

The Strategic Assessment led the Victorian Government to make commitments to the Commonwealth Government in relation to conservation outcomes and measures to protect matters of national environmental significance.

A key purpose of the Strategy is to identify important populations of the SBB, areas of habitat to be protected, and habitat corridors to provide connectivity between populations. The Strategy was prepared using a study area extending from Koo Wee Rup swamp in the east to Frankston, and Westernport in the south to the Pakenham foothills. It therefore encompassed the Pines FFR.

5.5 Ecological Connectivity Plan

Practical Ecology Pty Ltd was commissioned by DSE on behalf of the partners to the Project to provide an Ecological Connectivity Plan for the south-east region of Melbourne. The main purpose of the study was to assess and evaluate existing and potential ecological connectivity with a view to establishing a document that guides the design and implementation of habitat links throughout the south-east region of Melbourne (Practical Ecology, 2010). This report identifies a SBB population cluster at The Pines, and linkages between The Pines FFR and Langwarrin FFR and also from the RBGC to remnant vegetation adjacent to The Pines.

Both the Ecological Connectivity Plan and draft SBB Sub-regional strategy identify remnant vegetation patches adjacent to The Pines as potential areas to secure and enhance or have been identified as stepping stones (within a regional context). These vegetation areas are located within the Frankston City Council (FCC) municipality.

5.6 Creating Fauna Linkages and Structure Designs

FCC has commissioned a study entitled '*Creating Fauna Linkages and Structure Designs*.' The key aim of the project is to reduce threats to declining fauna populations within the municipality. There is increasing recognition that maintaining or restoring ecological connectivity or 'habitat linkages' is critical to preserving ecological diversity in urbanised landscapes. A key component of the project is to identify major localities where faunal movement is impeded (such as by roads) and where fauna crossing structures would facilitate connectivity among faunal populations as well as reducing wildlife mortality rates (A. O'Malley, pers. comm. 2012).

As LMA is not positioned to undertake works outside of the Peninsula Link project area, LMA can only provide information as part of the Peninsula Link project. Therefore, LMA will participate in workshops as part of FCC's *Creating Fauna Linkages and Structure Designs* study and provide information obtained on habitat connectivity.

5.7 Ecological character description

In response to condition 2(h) (connectivity),LMA commissioned ARCUE to prepare an Ecological Character Description (ECD) for the SBB, comprising a guide to recovery planning (ARCUE, 2012b) and an action plan (ARCUE, 2012c). DEPI has coordinated the development of the ECD. These documents are included in Appendix 3 and Appendix 4.

The ECD is provided in order to form a consistent view of SBB ecology. An ECD provides a conceptualisation of the key processes, components and services of an ecosystem at a given point in time. The ECD has been prepared to assist recovery projects currently in operation and planned for the future so that they can align with the key objectives of the Victorian Draft Action Statement and National Draft National Recovery Plan for the SBB.

The ECD comprises a synthesis of current knowledge and projects undertaken to form a baseline of SBB ecology. This synthesis has been undertaken with the assistance of many researchers, community groups, local government and State government personnel.

The ECD also aims to assist the Regional Recovery Group established by the Westernport Biosphere and the formation of the Regional Recovery Plan by providing a background to the current knowledge of the Southern Brown Bandicoot. The program provided also aims to assist in the ongoing co-ordination of the various recovery programs being implemented by such groups as the Regional Recovery Group and the Westernport Biosphere with government priorities and programs such as those identified in the Southern Brown Bandicoot draft Sub Regional Strategy (DSE 2011) and Biodiversity Conservative Strategy (DSE 2011).

5.8 Management approach for the Pines Flora and Fauna Reserve

Parks Victoria has developed a "Levels of Protection Framework" (Parks Victoria, 2006) or strategic state-wide approach to allocate broad conservation objectives and determine management and resourcing priorities for the parks and reserves network. The framework categorises parks and conservation reserves according to biodiversity criteria and each of six categories or groupings have defined typical characteristics, conservation objectives and an assigned level of protection.

The Pines FFR is currently assigned to a level-D park grouping based on its relatively small size, low number of threatened flora and fauna species (i.e. less than 15), low proximity/adjacency to native vegetation areas, moderate levels of internal fragmentation and generally prone nature to edge effects.

The overall conservation objective for D-rated parks/reserves is to maintain the current condition of specific values of high conservation status that have high intrinsic viability within the park or reserve, allowing the natural processes of regeneration, disturbance and succession to occur. D-rated parks and reserves generally have a priority for active management of emerging threats only, except where there is a high risk to specific susceptible attributes that are exceptionally under-represented and rare/depleted, or that pose long term threat to adjacent high values.

The management focus for the Pines FFR is to aim to maintain the high condition of the remnant EVCs (as assessed by Biosis Research in 2008) and their fauna habitat values. In addition, management will aim to progressively restore EVCs in moderate to low condition through revegetation encouragement of natural regeneration and pest plant control.

While the Pines FFR is classified as a nature conservation reserve, it also has an important open space and recreational role in context with Melbourne's Open Space Strategy - Linking People and Spaces (Parks Victoria, 2002), the Frankston City Open Space Strategy and it is expected that there will be an increase in pressures for recreation due to its location within an urban growth area.

5.9 Management objectives in first version of SBB Management Plan

The first version of the SBB Management Plan (ARCUE, 2010) identified a series of specific goals for the management of SBB at the Pines FFR, which included:

- Ensuring that the construction and operation of Peninsula Link does not prejudice the long term viability of the population of SBB within the Pines FFR
- Ensuring animal welfare and population viability by achieving zero mortality of SBB as a result of construction works and operation of Peninsula Link
- Allowing for movement of SBB and other native species across and along Peninsula Link
- Facilitating movement required for dispersal (gene flow), and a low rate of daily movements.

These objectives were based on information from the EES, which identified a population of SBB existing within the Pines FFR. Pre-construction and during construction monitoring failed to identify the distribution or abundance of the SBB population at the Pines FFR and it is now currently believed to be limited to a few individuals or locally extinct. It should be noted that there has been limited SBB detection during surveys, with one hair sample identified during pre-construction monitoring, and also one hair sample identified during construction surveys.

Therefore, given the availability of further information, it is appropriate to revisit the management objectives and actions.

5.10 Summary and management implications

The threats and preferred management actions are consistently identified across the strategies and plans outlined above. The Regional Recovery Plan and PVA notes that the Pines FFR has, or may have, experienced a local extinction of the SBB.

DEPI is the lead agency for the strategic management of the SBB. It is currently reviewing its species specific management, strategy and action plans. At this stage the Pines FFR is not identified as a critical habitat area or population for the SBB in the region. DEPI is focusing on maintaining and improving connectivity in a way that enhances overall habitat availability at a landscape scale and identifying long-term actions to guide investment and planning for the recovery of SBB.

The draft Regional Recovery Plan identifies the potential for captive breeding populations but comments on its complexities. It also notes that the success of fox control and the effect of pest predators must be determined

Given that the population is considered to be extremely small or potentially now locally extinct, the objectives for this plan will focus on enhancing SBB habitat at the Pines FFR to provide suitable habitat in the event that future connectivity corridors are secured to facilitate SBB movement from other locations. The objectives are presented in Section 7.

6 Review of management actions

The first version of this SBB Management Plan for the Pines FFR required that the management plan be reviewed in 2012. Since 2010, there have been significant developments in both research and strategy, as discussed in Sections 4 and 5. It is therefore appropriate to review the actions required to satisfy the EPBC approval conditions in light of this information.

A number of actions from the original management plan remain relevant and appropriate, such as:

- Rehabilitation of the vegetation in the former orchard and KTRI
- Maintenance of a predator control and monitoring program
- Assessment of the effectiveness of the culverts and underpass under Peninsula Link for retaining connectivity of habitat for the SBB

Condition 6 of the EPBC approval (2007/3480) for the project allows the proponent to submit a request for revision of the plan to the Commonwealth Minister. There are three EPBC conditions which merit further consideration, as follows:

- Condition 2 (c) Installation and maintenance of a predator proof fence around the boundary of the Pines FFR
- Condition 2 (c) Identification of impact thresholds that will trigger management intervention
- Condition 2 (e) Discuss a range of options for offsets in the event that the SBB population in the Pines Reserve continues to decline, including the last resort option of translocation.

6.1 Predator proof fence

Condition 2 (c) of the EPBC approval requires installation and maintenance of a predator proof fence around the boundary of the Pines FFR.

As discussed in the PVA (see Section 4.6), all scenarios with the addition of a well maintained, predator-proof fence around the perimeter of the reserve or a smaller enclosure greatly improved the viability of SBB at the Pines FFR. However, the feasibility of building and maintaining a predator-proof fence at the Pines FFR must also be considered. The PVA assumes that the fence is well maintained so that it continues to be effective. Without sufficient management and predator control, the viability of the population within the fenced area would be reduced (ARCUE, 2011a).

Parks Victoria is the land manager of the Pines FFR (see Section 3.3). Parks Victoria has prepared a report considering the feasibility of implementing and maintaining a predator proof fence at the Pines FFR. This report takes into account both the technical considerations and the strategic context. The report is attached in Appendix 1.

A preliminary concept design for the predator proof fence was prepared by LMA in consultation with Parks Victoria and the Country Fire Authority (CFA). The design identified a number of key issues. One major issue is the requirement for fire management including wildfire control, life and asset protection. As a consequence of this requirement a significant amount of native vegetation will be required to be removed for the installation of the perimeter predator proof fence. Also there is the need to provide several points of egress in addition to other points of entrance specifically for emergency and fire management purposes. These points of exit/entrance are potential points of weakness in the effectiveness of the fence.

Condition 1 of the EPBC approval limits the amount of native vegetation that may be removed in the Pines FFR to 11 hectares. The native vegetation to be removed for the installation for the predator proof fence in conjunction with the native vegetation that has already been removed for the construction of Peninsula Link would exceed the 11 hectare limit.

Neither Parks Victoria nor DEPI support the installation of a predator proof fence in context of reserve planning, the fact that population in the Pines FFR is considered to be very small or potentially locally extinct compared with the cost of the fence installation and management and in consideration of the objectives of the Sub Regional Strategy. Parks Victoria is convinced that a predator proof fence at the Pines FFR will not achieve objectives for sustainable recovery of the SBB in the reserve due to the level of current and expected on-going threats (see Section 4.5).

Parks Victoria has concluded that if a predator proof fence is established, there will be on-going high risks of fox predation due to certain breaches of any fence and due to the inability to undertake any significant fox control in surrounding residential/urban areas to reduce fox challenges to a fence. It is also anticipated that fire will continue to pose a major threat, and contribute to on-going predation threats, as the reserve is one of several parks and reserves in the South East Metropolitan Region with the highest incidence of fire on public land primarily due to arson.

An ineffective predator proof fence, primarily due to expected fence vandalism will reduce the viability of any SBB population within the fenced area. While a survey of neighbour attitudes undertaken in 2009 identified a fence as being important, some 34% of respondents were satisfied with the existing fence and some 47% considered it average (noting that only 3% of 2500 distributed surveys responded). No survey has been undertaken on the establishment of a new feral proof fence, however Parks Victoria believes that there would be concerns with the visual prominence of such a fence based on the extent of vegetation clearance required and concerns that the fence would be seen as a barrier to community accessibility. Parks Victoria believes that the existing security style fence has social impacts on adjacent communities and presents an uninviting image. The influence of a fence on perceived accessibility may mean that many do not take the opportunity to engage with or connect with the place and do not receive the well-acknowledged health benefits of connecting with nature.

In addition, the Pines FFR is not a strategic location for the protection and recovery of the SBB within the region (see Section 5). The investment in implementing and maintaining a predator proof fence in the Pines FFR, which is predicted to have a high level of ongoing threats, could be used more effectively to protect and recover SBB elsewhere within the region with lasting benefits for the species population based on a one-off investment (see Section 6.3). The Pines FFR would require significant ongoing investment from Government to ensure any potential future benefits from any proposed management actions.

Therefore it was proposed that the condition to install and maintain a predator proof fence around the boundary of the Pines FFR be altered. Section 6.4 discusses the alternative management options for transfer of investment in SBB recovery.

6.2 Identification of impact thresholds

Condition 2 (c) Identification of impact thresholds that will trigger management intervention.

As a result of monitoring (see Section 4.4) it is now thought that the population may comprise a few individuals or is potentially locally extinct within the Pines FFR or is locally extinct. A viable population would require the installation of a predator proof fence and reintroduction and the fence is no longer proposed (see Section 6.1).

Since the original version of the SBB Management Plan, there have been significant developments in the strategy for the protection and recovery of the SBB in the region (see Section 5). While playing a limited role, the Pines FFR is not identified as a strategic location.

Given the changed strategic focus, the potential for only a few individuals remaining (if not already locally extinct) and the high level of threats within the Pines FFR, LMA is unable to identify impact thresholds that will trigger management intervention. LMA therefore proposes to provide offsets that support the strategic directions identified (see Section 6.3) rather than committing resources within the Pines FFR which are not expected to lead to long-term and ongoing effective outcomes for the SBB. The LMA commitment to the Pines FFR will focus on habitat enhancement consistent with the draft Sub-regional strategy and Parks Victoria's aims and conservation objectives for the reserve.

6.3 Discussion on Range of Options for Alternative Actions

Condition 2 (e) requires LMA to discuss a range of options for offsets in the event that the SBB population in the Pines FFR continues to decline, including the last resort option of translocation.

LMA is not proposing to install a predator proof fence and the funding originally allocated to the predator fence will be reallocated for the implementation of alternative actions. These are discussed in the following sections. LMA considers that the funding available for actions will be more effective in the protection and recovery of SBB where it is provided in the context of the co-ordinated regional and sub-regional approach.

6.3.1 Translocation

Monitoring has identified that the SBB population in the Pines FFR is likely to consist of only a few individuals or be locally extinct. The PVA suggested that installation of a perimeter fence or smaller (50 ha) fenced area may support a translocated population of SBB if managed under similar predator control and planned burning regime as the population of SBB at the Royal Botanical Gardens in Cranbourne. To maintain a translocated population, a predator proof fence would be required at the Pines FFR and as stated in Section 6.1, however it is considered that the construction of a predator proof fence is not feasible and is not proposed to be installed (see Section 6.1).

In addition, translocation of SBB would require:

- Sourcing large numbers of animals. The source population would need to be sufficiently robust to survive removal of a substantial amount of individuals.
- Intensive management in terms of initial husbandry and habitat management over an estimated five to ten years; followed by ongoing intensive habitat management for the life of the population.

- Intensive species management within a reserve that has existing and predicted increasing recreational uses and high threats to SBB typical of an urban environment will be difficult and require significant ongoing resources to be allocated. Also translocation by DEPI into the Pines FFR is not considered a priority at this stage (Nicholls & Coates, 2011).
- The threats (see Section 4.5) are expected to be ongoing and would therefore also pose major constraints on the viability of any potential translocation population particularly given there is no current habitat connectivity to other areas with suitable SBB habitat and the Sub-regional Species Strategy does not give any priority to corridors connecting with the reserve.

Therefore translocation of SBB into the Pines FFR is not proposed. DEPI and Parks Victoria do not support the translocation of SBB into the Pines FFR at this time. Section 6.3.2 discusses the alternative management actions proposed.

6.3.2 Summary of Action Plan

LMA commissioned the development of the Ecological Character Description and Action Plan (ARCUE, 2012c) to support the recovery and understanding of the SBB. The purpose of the Action Plan is to prioritise issues that are threatening the long term viability of the SBB in south-east Melbourne. There are many threats to SBB. The Action Plan focuses on the main criteria for listing the species under the Commonwealth *EPBC* Act and the Victorian *FFG* Act.

This Action Plan synthesises and prioritises the recovery actions being taken by a wide range of agencies and groups across the region. The Action Plan aims to contribute to actions in the draft Action Statement and National Recovery Plan for the SBB. It will also prioritise and address the identified gaps in knowledge from the Action Statement and National Recovery Plan.

The action plan identifies a range of co-ordinated, broad agency involvement management actions for the protection of the SBB in the south east region of Melbourne. The action plan proposes objectives and subsequent actions to:

- Reduce fox numbers to a level in which there is an improvement in SBB numbers
- Decrease number of feral cats to reduce their impact of SBB populations
- Improve control of domestic dogs and cats to reduce their threat to SBB
- Reduce the likelihood and number of road related mortality
- Increase knowledge on species distribution, abundance, and population dynamics and preferences to further ensure its protection
- Increase public awareness and education of SBB
- Increase connectivity between SBB habitat and reduce fragmentation
- Increase the amount of suitable SBB habitat available
- Increase the quantity of SBB habitat
- Reduce the impact of inappropriate fire regimes on SBB habitat and populations

The action plan has been prepared in consultation with key stakeholders.

6.4 Alternative Management Actions

Given that no SBB have been found in the Pines FFR, the installation and maintenance of a predator proof fence around the reserve would not result in any conservation benefit for the SBB. Accordingly, Biosis was engaged to complete an independent assessment of the suitability and effectiveness of various predator control and management measures that could be used in various locations to achieve a net environmental and conservation benefit for the SBB.

In accordance with condition 6 of the EPBC Approval (EPBC 2007/3480), LMA sought approval to carry out an alternative activity instead of the installation of a predator proof boundary fence around the Pines FFR.

The Biosis assessment, contained in their *Advice Regarding Strategies for the Protection of the SBB*, includes analysis of predator proof fencing around the Pines FFR and alternative sites, as well as alternative measures such as predator control programs. A copy of the submission and Biosis report is included in Appendix 6.

The Biosis report recommends that a combination of alternative predator control and management measures, particularly fox baiting programs in several nature conservation reserves, would be significantly more likely to achieve a net conservation benefit for the SBB. It is proposed that these alternative actions are adopted and this is discussed further in Section 8.7 of this plan.

6.3.3 Funding Transfer

LMA proposes to contribute funding that had been set aside for the installation and maintenance of the boundary predator proof fence at the Pines FFR towards the implementation of alternative actions as detailed in the Biosis report. This is discussed further in section 8.7.

7 Management Plan objectives

7.1 Objectives for the management of Southern Brown Bandicoots

The objectives for this SBB Management Plan are as follows:

- To monitor for presence/absence of SBB within the Pines FFR utilising the fauna underpasses and aim to protect any SBB population that may persist
- To survey any incidental signs of SBB presence within the Pines that may be recorded by Parks Victoria Rangers and volunteers
- To monitor the fauna underpasses and their use by other fauna including predators
- To track habitat condition for SBB within the Pines FFR. The aim would be to provide information to inform Parks Victoria's progress in maintaining and restoring the condition of EVCs and to facilitate adaptive management responses as may be determined necessary to improve the habitat condition
- To contribute to the implementation of the recommended actions for the recovery of the SBB in south-east of Melbourne.

7.2 Management Plan implementation, timeframe and review

LMA will implement, or arrange the implementation of, this plan in the post-construction phase of this project (early 2014 to 2020). Parks Victoria is the land manager for the Pines FFR and will be responsible for the implementation of the plan in the post-construction phase. DEPI is responsible for the management of wildlife within Victoria, and will guide Parks Victoria in the strategic management of SBBs both within the Pines FFR and surrounding environs.

7.3 Funding

The implementation of the plan requires a whole of government approach. LMA will fund the plan until early 2014 and then facilitate funding arrangements for the implementation of the plan for the remaining period (until year 2020), at which point the need for further monitoring and management measures will be reviewed.

It should be noted that the Victorian Government may transfer, assign or novate LMA's functions and obligations under the SBB Management Plan to another public entity (which may be a Victorian government department, statutory authority or corporation), who will then assume all of LMA's functions and obligations under the SBB Management Plan including funding of the commitments. It is initially expected that LMA will assign its functions and obligations under the SBB Management Plan to Parks Victoria post construction, potentially in early 2014. LMA will consult with and provide sufficient notice in writing to the Commonwealth Environment Minister prior to any proposed transfer, assignment or novation including the notification of funding allocation.

LMA notes that transfers of approval conditions, or part thereof, must be approved in writing by the Commonwealth Environment Minister consistent with Section 145B of the EPBC Act.

7.4 Formal review

The management plan will undergo a series of formal and informal reviews during its lifetime.

A formal review will occur at the end of the remaining seven years (Dec 2020).

Informal reviews of progress will be undertaken annually throughout the life of the plan.

LMA notes that revisions to the management plan, as a result of informal or formal reviews, or otherwise, must be provided to the Commonwealth Environment Minister for approval consistent with Condition 6 of the approval for this project under the EPBC Act.

7.5 Corrective action

As part of the above-mentioned plan reviews, performance will be assessed and recommendations will be made as to whether adaptive management actions need to be implemented.

8 Managing Southern Brown Bandicoots at the Pines Flora and Fauna Reserve post June 2012 to Dec 2020

This section of the SBB Management Plan details the management actions that have occurred or will occur from June 2012 to Dec 2020.

8.1 Monitoring

The broad aim of the post-construction monitoring within the Pines FFR is to ensure the ability to detect an increase in the size or distribution of the SBB population within the Pines FFR and be able to respond appropriately.

8.2 Mortality

No SBBs are expected to be found along Peninsula Link within the Pines FFR. The road design includes barriers to prevent fauna from entering the road. See section 4.5.2.

Action:

No specific action is proposed for SBB as no SBB are expected to be found along the Peninsula Link roadway within the Pines FFR. However, as significant effort has been made to facilitate fauna connectivity corridors across and along Peninsula Link, LMA will monitor road mortality for any fauna on a daily basis for three months in Autumn 2014, and for three months in Spring 2014.

8.3 Predator control

The primary objective of the predator-control program during the post-construction phase is to maintain and enhance the survival prospects of the small population of SBB that may still persist and for native fauna by reducing the density of introduced predators within the Pines FFR. Reducing grazing of native vegetation is important to maintain habitat condition, facilitate regeneration and protect revegetation.

Foxes and cats should be controlled using a combination of trapping and den fumigation and rabbit control will use poison baiting.

Specifically, the active searches for signs of SBB in Autumn and Spring each year will also include an inspection of all known fox dens, as foxes regularly re-use dens. A register of the locations of each fox den and an assessment of its status (occupied, unoccupied etc) will be maintained and reported on. Reports will be made available to DEPI, and DOTE upon request. Additionally, searches for fox dens on adjacent properties may be undertaken each year if possible and agreed to by landowners. Active dens will be fumigated while the cubs and preferably the vixen are inside, which occurs from approximately August through to September.

Trapping will occur using the same methods as during the pre and during-construction techniques. A series of three programs, each of 10 days duration, will be undertaken each year. As an alternative to three 10 day programs, two programs each of 15 days duration, or one program of 30 days, will be undertaken each year. The timing of each trapping program will aim to maintain a reduced density of foxes at the Pines FFR. The exact timing may vary from year to year depending on levels of fox activity and reinvasion rates, and success of den fumigation works previous program outcomes, other programs being undertaken in the area and weather. However as a guide, trapping should occur in spring, summer and autumn.

Action:

The dates and duration for the trapping and fumigating program may alter depending on site conditions, other programs in the area and the number of foxes caught, however as a minimum Parks Victoria will run the program for 30 days over the year for the next seven years as part as an integrated pest animal control program. A report will be prepared each year detailing the results, and will be made publicly available.

Encourage the City of Frankston and other adjacent land managers to undertake fox control including den fumigation.

8.4 Habitat enhancement

A range of works are planned to be undertaken within the Pines FFR to enhance fauna habitat. This includes continuing on with the five year targeted weed control plan, continuing with revegetating 16 hectares of the degraded former orchard area, and fire management.

8.4.1 Weed management

LMA commissioned weed surveys and the subsequent preparation of a Weed Management Plan for the Pines FFR (LMA, 2010*).* The Weed Management Plan aims to enhance habitat for the SBB within the Pines FFR and provide prioritised areas for weed control based on habitat establishment, connectivity, and enhancing existing natural values (Ecology Partners, 2010a). The Weed Management Plan identifies woody weeds within the Pines FFR and details an indicative program for their management over a five year period.

There are two focus areas for the weed management under this plan (see **Figure 3**).

Zone 1 is located on DPI (former KTRI) land and areas of the former Department of Agriculture and Rural Affairs (DARA) land which adjoins and surrounds the LMA revegetation area. The focus of Zone 1 is to establish medium and longer term habitat and connectivity for SBB and other fauna species. Zone 1 is currently in a highly degraded state and is dominated by Sallow Wattle, Coast Tea Tree, Radiata Pine, Boneseed and Blackberry (Ecology Partners, 2010a).

The second areas of priority include Zone 2, which is considered existing core habitat areas of the Pines FFR. Zone 2 contains vegetation of good condition and support a wide variety of flora and fauna. Areas within Zone 2 provide known habitat for SBB (Ecology Partners 2010a).

LMA has allocated $100,000 for delivery of the five year Weed Management Plan. This funding will initially be allocated to the highest priority areas, being those areas in Zone 1. Once the desired outcomes for the Zone 1 areas have been completed, any remaining funding will be allocated to areas in Zone 2. The desired outcome for Zone 1 is to reduce the extent and distribution of woody weeds to allow natural regeneration to occur (Ecology Partners, 2010a). Achievement of this outcome will:

- enable Zone 1 to be included in the Pines FFR's recurrent weed control program post-2015;
- help to provide suitable habitat and a corridor for the movement of the SBB; and
- support revegetation of the former orchard site.

At the time of the preparation of this plan, LMA had commenced weed control in both the Zone 1A and Zone 1B areas, with works set to continue for the remaining 2 years of the Weed Management Plan.

To ensure that weed management works are also undertaken in Zone 2 areas, as part of the Alternative Management Actions (see Section 8.7.3), $80,000 will be allocated over 4 years to weed management and monitoring in Zone 2 areas from 2014/2015 until 2017/2018. This will have the effect of enhancing core habitat areas for the SBB.

Parks Victoria will also undertake weed management in accordance with conservation objectives as identified in the Management Statement to be prepared in 2014/15.

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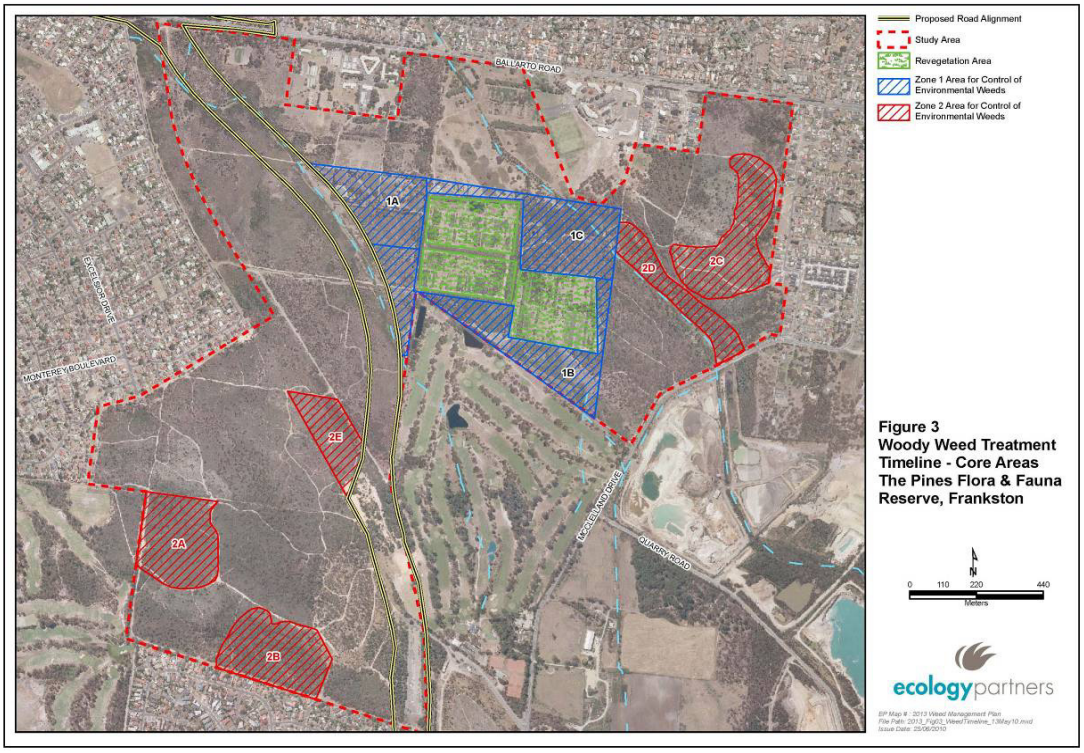

Figure 3 - Weed Treatment Areas (extracted from Ecology Partners, 2010)

Action:

Parks Victoria and LMA will continue with the weed control for the remaining 2 years in accordance with the five year Weed Management Plan. Parks Victoria and LMA has undertaken approximately $60,000 worth of weed control works in Zone 1 to date with approximately $40,000 remaining to be spent in Zone 1 (or possibly Zone 2, if the desired outcomes are achieved earlier than anticipated) over the next two years. As part of the Alternative Management Actions (see Section 8.7.3), $80,000 will be spent over 4 years on weed management and monitoring in Zone 2 areas (2014/15 - 2017/18).

Parks Victoria will undertake weed management as necessary to achieve the conservation objectives as identified in its Management Statement and as outlined in the Weed Management Plan. The Management Statement and Weed Management Plan are intended to be consistent on these matters.

8.4.2 Fire management

Fire in the reserve is managed in accordance with the East Port Phillip Fire Protection Plan (DSE 2003), the Code of Practice for Fire Management on Public Land (DSE 2006) and the Guidelines and Procedures for Ecological Burning on Public Land in Victoria (DSE 2004).

Implementation of the Fire Protection Plan is undertaken through the DEPI three year rolling Fire Operations Plan for the Central Area Fire District prepared in consultation with key stakeholders and the community. This operations plan identifies annual fire prevention works including proposed burning, slashing and vegetation clearance activities as well as works to maintain fuel breaks and management tracks. The Reserve has a fuel break around the boundary and an extensive network of management tracks for both fire protection and fire suppression purposes. A range of fuel break improvements have been recently implemented under the Melbourne Bushfire Protection Program. The development of Peninsula Link, with elevated walls and barriers has resulted in a substantial new "fuel break" bisecting the Reserve.

Fire management in the Reserve will continue to give priority to the protection of human life and property and aim for ecologically appropriate fire regimes to maintain the reserve's natural ecosystems.

The use of fire for ecological objectives will aim to meet the objective to enhance SBB habitat given that the natural habitats historically support SBB. Currently there is only 35 ha that has not been burnt for at least 21 years that is suitable for mosaic burning within the tolerable fire intervals for the EVCs. An ecological burning plan will be prepared, however a cautionary approach will be taken to allow for unforseen fire events (e.g. deliberately lit fires which may burn large areas including those areas currently suitable for mosaic burning). Proposed ecological burns will be integrated into the annual fire operational planning process and be subject to community consultation.

Action:

Parks Victoria will address fire management objectives for enhanced SBB habitat in its Management Statement for the Pines FFR to be prepared in 2014/15. Fire Management objectives will be reviewed annually.

8.4.3 Revegetation of former orchard

LMA commissioned the preparation of a Revegetation Management Plan for the former orchard area within the Pines FFR (Ecology Partners, 2010). The Revegetation Management Plan was prepared to meet EPBC condition 2(b): '*Rehabilitation of the vegetation on the former orchard and Keith Turnbull Research Institute to provide approximately 16 ha of additional SBB habitat*'.

The proposed revegetation area comprises approximately 16 hectares of land previously occupied by an orchard site in the eastern section of the reserve. The area is highly degraded and little remains of its original vegetation apart from some colonising natives. The majority of remaining vegetation is either remnants of fruit trees or environmental weeds (Ecology partners, 2010b).

The aim of the Revegetation Management Plan is to revegetate the former orchard area over a 10 year period within the Pines FFR with the aim of establishing and maintaining suitable habitat for SBB (Ecology Partners, 2010b). The site investigation of the EVCs occurring in the immediate vicinity were noted to be the pre-1750 EVCs that would have dominated the orchard site and are consistent with the Damp Sands Herb-rich Woodland and Swampy Riparian Woodland EVCs (see **Figure 4**).

At the time of the preparation of this plan, LMA has completed site preparation works and has enclosed the site within rabbit-proof fencing, and has cleared the site of debris and undertaken weed control works. Planting of the site has commenced in accordance with *The Pines Flora and Fauna Reserve Revegetation Plan for the Former Orchard Site, September 2010* (see Appendix 7).

Action:

LMA and Parks Victoria will continue with implementation of the revegetation of the former orchard, in accordance with *The Pines Flora and Fauna Reserve Revegetation Plan for the Former Orchard Site, September 2010* (Ecology Partners Pty Ltd, 2010). The plan will be implemented by 2020.

Figure 4 - Revegetation Site: EVC Locations

8.5 Monitoring of habitat condition

Ecological surveys and assessments were undertaken by Biosis Research in 2008, to prepare the report: Flora and fauna assessment of The Pines Flora and Fauna Reserve Frankston, Victoria: 12 months of seasonal survey 2007/08 August. Section 3.1.3 and figure 6 of this report provides an assessment of the vegetation condition of the remnant EVCs and can be used as a base for a comparison of habitat condition.

The aim of monitoring of habitat condition is to provide information to inform Parks Victoria's progress in maintaining and restoring the condition of EVCs and to facilitate adaptive management responses as may be determined necessary to improve habitat condition.

Habitat condition monitoring is undertaken every 3 years in accordance with Parks Victoria's State of the Parks reporting requirements. Habitat condition monitoring assesses the condition, extent and trend for weeds and habitat condition. In 2013, monitoring suggested that the extent and impacts of weeds in the Pines FFR from 2010-2013 was stable, and that there had been a decrease in the extent and impacts of selected priority weed species being managed. The overall condition for Heathy Sands was maintained over the same period.

An assessment similar to that undertaken by Biosis in 2008 (excluding fauna surveys) will be undertaken in 2018 and entail establishment of permanent quadrants to enable detection of changes in condition over time.

Action:

Parks Victoria will undertake a habitat condition assessment of the Pines FFR in 2018 and establish permanent quadrants to measure changes in habitat condition over time. The information will be used by Parks Victoria in the management of the Pines FFR.

8.5.1 Weed monitoring

Consistent with the approach proposed by the Pines Flora and Fauna Reserve Weed Management Plan, June 2010, a monitoring regime will be implemented at the Pines FFR to determine the effectiveness of the weed management works undertaken in accordance with section 8.4.1 of this plan. Specifically, monitoring will be undertaken in Zone 1 in 2014/15 (the end of the 5 year weed management program) for comparison against the results of monitoring already undertaken in 2010/11 (the start of the 5 year weed management program). Monitoring will also be undertaken in Zone 2 in 2014/15 (the start of the 4 year weed management program) and again in 2017/18 (the end of the 4 year weed management program). Parks Victoria will be delivering the monitoring program to create continuity across the Pines FFR and in accordance with departmental protocols (Ecology Partners,2010a).

Action:

Parks Victoria will undertake weed monitoring in 2014/15 (Zones 1 and 2) and 2017/18 (Zone 2) to assess the effectiveness of the weed management works and inform Parks Victoria's development of weed management strategies for the Pines FFR.

8.5.2 Revegetation site monitoring

An ongoing monitoring program detailing the progress of revegetation works will be undertaken throughout the 10 year implementation of the Revegetation Management Plan at Appendix 7. (Ecology Partners,2010b). Monitoring will commence in the first year of revegetation works and be undertaken then annually until year 5, before then being undertaken again in Year 10. Monitoring of the revegetation site will include:

- Ensuring that revegetation works are on track to meet the 10 year targets
- Regularly monitoring for weeds in revegetated areas, and implement weed control measures as necessary.

Action:

Parks Victoria will undertake weed monitoring on the 16 hectare revegetation site in accordance with the Revegetation Management Plan.

8.6 Habitat connectivity

LMA is not positioned to undertake works outside of the Peninsula Link project area, and LMA can only provide information as part of the Peninsula Link project. LMA has participated in workshops as part of FCC's *Creating Fauna Linkages and Structure Designs* study and provided information obtained during the course of the project on habitat connectivity.

Also in response to condition 2(h) (connectivity), LMA commissioned ARCUE to prepare an Ecological Character Description (ECD) for the SBB, comprising a guide to recovery planning (ARCUE, 2012b) and an action plan (ARCUE, 2012c). DEPI has coordinated the development of the ECD. These documents are at Appendix 3.

Action:

No further action proposed.

8.7 Alternative Management Actions

LMA, in its project budget, allocated $1 million for the installation of the fence and $60,000 per year for the maintenance of a predator proof fence over a ten year period. This fence is no longer proposed. Instead LMA will contribute $1.6 million towards the implementation of alternative management strategies for the protection of the SBB in the south east of Melbourne, within the Gippsland Plains Bioregion, as recommended in Biosis' report.

The following are actions that will be implemented at the key conservation sites identified in the Biosis report as an alternative to enclosing an area of SBB habitat with predator resistant fencing. A superior conservation outcome is more likely to be achieved for the SBB at these sites than would otherwise be achieved through the installation of predator resistant fencing of potentially locally extinct SBB at the Pines FFR.

8.7.1 Southern Brown Bandicoot Action Plan

Develop a SBB Action Plan for Adams Creek Nature Conservation Reserve (NCR) and Wonthaggi Heathlands NCR / Kilcunda Harmers Haven Coastal Reserve by the end of 2014. The Action Plans will focus on actions that will maintain and enhance the SBB populations within the Reserves.

8.7.2 Fox baiting and cat trapping on key public land sites

Undertake ongoing fox baiting augmented with cat trapping within Adams Creek NCR, Wonthaggi Heathlands NCR / Kilcunda Harmers-Haven Coastal Reserve for a 10 year period, including ongoing monitoring of the responses of both fox and bandicoot populations within the reserves to the baiting program.

A monitoring program will be developed to determine the effectiveness of the baiting program through bait uptake rates by the end of 2014, spotlight transect counts of foxes or other methods. The information will be used to modify the baiting program as necessary to achieve a reduction in fox abundance of at least 75% by 2024. The baiting program will be reviewed in 2017 to determine its effectiveness at each reserve. At this time, should it be determined that baiting efforts should be concentrated at one reserve for the protection of the SBB, then this will be discussed with SEWPAC prior to implementation. Any changes to this plan, including a decision to alter monitoring regimes, must be approved by the Minister in accordance with condition 6 of the EPBC approval for this project.

This plan proposes a 2 year cat trapping trial only to determine whether cats adversely affect SBB populations. Cat trapping will occur once in 2014 and twice in 2015. Any cats trapped during this trial will also be sampled for toxoplasmosis. Key performance indicators for the cat trapping trial are:

- keeping records of the number and type of cats trapped, and the location and approximate date/time of their trapping;

- ensuring all cats trapped are sampled for toxoplasmosis, and appropriate records are kept of the results;
- ensuring these records are made available to DOTE, DEPI, Parks Victoria and others upon request (to the extent they are not already publicly available);
- when considered together with the SBB monitoring program results, determine whether the cessation of the cat trapping trial at the end of 2015 has any impact on SBB populations at the Adams Creek NCR and Wonthaggi Heathlands NCR.

8.7.3 Ongoing habitat enhancement at the Pines FFR

The Sub regional Strategy (SRSS) for Southern Brown Bandicoot was revised in January 2014. The Pines FFR does not form part of the SBB management area under the revised SRSS as, although the site is recognised has having the potential to provide SBB habitat, there is no recent record of a SBB population in that area.

As stated in section 8.4.1 above, LMA commissioned weed surveys and the subsequent preparation of a Weed Management Plan for the Pines FFR (LMA, 2010*).* The Weed Management Plan aims to enhance habitat for the SBB within the Reserve and provide prioritised areas for weed control based on habitat establishment, connectivity, and enhancing existing natural values (Ecology Partners, 2010a).

As described in section 8.4.1, LMA has already allocated $100,000 over 5 years (2010/11-2014/15) to weed management and monitoring in the highest priority areas in Zone 1. Once the desired outcomes are achieved, any remaining funding will be allocated to Zone 2. As part of the Alternative Management Actions, however, a separate $80,000 over 4 years (2014/15-2017/18) has been allocated to weed management and monitoring in Zone 2. This will provide funding for weed management and monitoring until 2015 (Zone 1) and 2018 (Zone 2).

8.7.4 Fox baiting on private land

Recent survey work undertaken by Biosis has identified several private land sites supporting populations of SBB (Biosis 2013). These include Gumbuya Park and two land parcels near the Princess Highway, all in Tynong North (Figure 2). There is also potential habitat in privately owned bushland contiguous with the Adams Creek NCR that is owned by a quarry company. There is also scope to provide incentives for private landowners adjacent to Quail Island NCR and Wonthaggi NCR to undertake fox baiting on their land (e.g. within 2 km of the reserves). It is possible that some or all of these land owners could be receptive to undertaking fox control measures on their land, particularly if it does not involve a personal cost and can be done with minimal inconvenience. It is recommended that an investigation is undertaken into the feasibility of including these areas in the fox baiting program. The fox baiting program should follow the recommendations in the Integrated Predator Control Strategy (Ecology Australia 2013) report prepared for Melbourne's Strategic Assessment, DEPI.

LMA has allocated $30,000 towards investigation and development of a fox baiting program on private land. This will also include Parks Victoria seeking funds from other sources to potentially fund the program.

These actions are outlined in greater detail in the table below.

Table 4 –Alternative Management Actions

No	Item	Action	Deliverable	Timing	Responsibility	Budget[1]	Comments
8.7.1.	SBB Management Plan	Investigate the potential for changing the land management status of Adams Creek NCR and Wonthaggi Heathlands NCR under Crown Land (reserves) Act 1978 to ensure they are managed primarily for nature conservation	Write a letter of support to DEPI requesting change of land classification	Dec 2013	LMA	$0	Parks Victoria has commenced discussions with DEPI regarding this matter.
		Design and undertake baseline SBB population monitoring and habitat mapping in Adams Creek and Wonthaggi Heathland NCRs.	Report detailing findings and recommendations to be made available to DOTE and DEPI upon request.	September 2014	Parks Victoria and DEPI	$100,000	The baseline studies will define the population size and extent using camera traps to identify the current distribution of the species, occupancy and key areas of activity, identify known and potential habitat and habitat quality. The baseline studies will allow comparison of pre baiting population status to population following implementation of the fox baiting program. LMA notes that the monetary savings achieved by excluding the live trapping and blood testing component of this action would be applied to the remaining approaved actions at Adams Creek and Wonthaggi Heathlands NCRS.
		Undertake baseline monitoring for foxes in Adams Creek NCR and Wonthaggi Heathlands NCR	Report detailing findings to be made available to DOTE and DEPI upon request.	September 2014	Parks Victoria	$20,000	The baseline monitoring will allow an index or pre-baiting fox activity to be developed which can then be used for comparison with post baiting activity

[1] LMA will spend $1.6 million on the management actions outlined in this SBB Management Plan. Although Table 4 provides an indicative budget for each action item, the actual allocation of funds (up to a total of $1.6 million) may vary depending on the actual cost of each action. For example, if a monitoring program can be completed under budget, the leftover funds will be reallocated to another action item in Table 4.

No	Item	Action	Deliverable	Timing	Responsibility	Budget[1]	Comments
		Develop a SBB Action Plan for Adams Creek NCR and Wonthaggi Heathlands/ Kilcunda Harmers Haven Coastal Reserve	Action Plan	September 2014	Parks Victoria	$10,000	The objectives of the Action Plans are to maintain and enhance the SBB populations in the Reserves. The Action Plan will identify key threats and actions to guide the recovery of SBB in these reserves. The Actions Plans will be adaptive and be reviewed regularly. The Action Plans will provide details of the baiting program including the target of reduction of fox abundance by 75% by 2024. The Action Plan will also propose measures in the event that populations of the SBB decline including concentration of baiting at one reserve over the other. This will be submitted to Department of Environment for review and approval.
8.7.2	Fox Baiting and Cat trapping on Key Public Land Sites	Develop and implement a program of fox control using buried 1080 baits within the Adams Creek NCR, Wonthaggi NCR and adjacent Kilcund-Harmers Coastal Reserve in accordance with the methods outlined in the Integrated Predator Control Strategy for the SBB in the south-east sub region.	Baiting program for ten years Report findings annually to Department of Environment. To be made available to DOTE and DEPI upon.	Sept 2014 to Dec 2024	Parks Victoria	$1,350,000	Details of the program to be included in SBB Action Statement Success of baiting strategy reviewed after 3 years Monitoring before and after the commencement of the baiting program to document whether the program has been effective at reducing fox abundance. Monitoring undertaken annually during the program.

No	Item	Action	Deliverable	Timing	Responsibility	Budget[1]	Comments
		Trial a program of cat trapping removal at Adams Creek NCR and Wonthaggi Heathlands NCR	Cat trapping program Report findings to Department of Environment. To be made available to DOTE and DEPI upon request.	2014-2015	Parks Victoria	$10,000	Undertake the program once in 2014 and twice in 2015. Depending on success of this, determine if cats are an issue. Samples to be collected from trapped cats to test for Toxoplasmosis.
8.7.3	Ongoing enhancement of habitat at the Pines FFR	Provide $80,000 over 4 years for weed management in Zone 2	Weed control in accordance with this plan	Until 2017/18	Parks Victoria	$80,000	To enhance core SBB habitat.
8.7.4	Fox Baiting on private land	Consult with the West Gippsland Catchment Management Authority and the Mornington Peninsula and Western Port Biosphere Reserve Foundation to identify opportunities to undertake fox baiting on key private land sites	Report to be prepared for DEPI outlining the location, nature and extent of any additional potential baiting on private land including the details of any legally binding agreements between land managers and the wind farm operator.	Late 2014	DEPI	$30,000	LMA has allocated $30,000 towards investigation and development of a fox baiting program on private land. Parks Victoria to source potential funding for program implementation.

Actions:

LMA will contribute $1.6 Million towards the actions outlined in the table above. The actions will be undertaken either by Parks Victoria or Department of Environment and Primary Industries as detailed in the table.

The funding re-allocation has been approved by the State Minister for Roads.

8.8 Summary SBB Management Plan Action Table

Table 5 below provides a summary of the SBB Management Plan Actions.

Table 5 - Summary of SBB Management Measures

Management Activity	Action/Performance Criteria	Timing	Responsibility
.1.1 SBB monitoring	Parks Victoria will undertake a monitoring program as outlined for seven years. A report documenting the results will be prepared after monitoring is completed each year.	Autumn and Spring until 2015	Parks Victoria
8.1.2 Monitoring of effectiveness of underpass	Parks Victoria will undertake a monitoring program as outlined for seven years. A report documenting the results will be prepared after monitoring is completed each year.	Spring/early Summer and late Summer/early Autumn until 2015	Parks Victoria
8.2 Mortality	No SBB are expected to be found along Peninsula Link within the Pines FFR. LMA will undertake 3 month monitoring along alignment for fauna, including the SBB.	Autumn and Spring 2014	LMA
8.3 Predator Control	The dates and duration for the trapping and fumigating program may alter depending on site conditions and the number of foxes caught, however as a minimum Parks Victoria will run the program for 30 days over the year for the next seven years. A report will be prepared each year detailing the results.	Yearly until 2020	Parks Victoria
8.4.1 Weed Management	LMA and Parks Victoria to continue with weed control works in accordance with The Pines Flora and Fauna Reserve Weed Management Plan (June 2010). Five year plan to be implemented by 2015.	Zone 1 - Five year plan to be implemented by 2015 Zone 2 - Until 2017/18	Parks Victoria
8.4.2 Fire Management	Parks Victoria to manage fire in accordance with Management Statement incorporating ecological burning	Burns integrated into ongoing Fire Operations Plan	Parks Victoria
8.4.3 Revegetation of Former Orchard	LMA and Parks Victoria to continue with implementation of the revegetation of the former orchard, in accordance with The Pines Flora and Fauna Reserve Revegetation Plan for the Former Orchard Site, September 2010.	Ten year plan to be implemented by 2020.	Parks Victoria
8.5 Monitoring of Habitat Condition	Parks Victoria will undertake a flora assessment of the reserve in 2018 which entails establishment of permanent quadrants to enable detection of changes in condition over time. The information will be used by Parks Victoria in the management of the reserve.	Zone 1 - until 2014/15 Zone 2 - until 2017/18	Parks Victoria

Management Activity	Action/Performance Criteria	Timing	Responsibility
8.5.1 Weed monitoring	A weed monitoring program will be undertaken for weeds throughout the Reserve area for two years after the implementation of initial weed management measures.	Zone 1 - Five year plan to be implemented by 2015 Zone 2 - Until 2017/2018	Parks Victoria
8.5.2 Revegetation site monitoring	Monitoring of the revegetation site will commence in the first year of revegetation works and be undertaken then annually until year 5, before then being undertaken again in Year 10.	Ten year plan to be implemented by 2020	Parks Victoria
8.6 Habitat connectivity	LMA to participate in workshops as part of FCC's Creating Fauna Linkages and Structure Designs study and provide information obtained on habitat connectivity. LMA commissioned ARCUE to prepare an Ecological Character Description (ECD) for the SBB, comprising a guide to recovery planning (ARCUE, 2012b) and an action plan (ARCUE, 2012c). DEPI has coordinated the development of the ECD.	Completed	No action proposed
8.7.1 SBB Management Plan	Undertake baseline monitoring of SBB population and habitat, and fox populations	September 2014	Parks Victoria
	Prepare action plans for the Adams Creek and Wonthaggi Heathlands NCRs	September 2014	Parks Victoria
8.7.2 Fox baiting and cat trapping on key public land sites	Develop and implement a program of fox control program using buried 1080 baits within Adams Creek and Wonthaggi Heathlands NCRs. Trial a program of cat trapping removal at Adams Creek and Wonthaggi Heathlands NCRs.	September 2014 to December 2024 Late 2014 (once) and 2015 (twice)	Parks Victoria
8.7.3 Ongoing habitat enhancement at the Pines FFR	Provide $80,000 over four years for weed management program in the Pines FFR	2014-2018	Parks Victoria
8.7.4 Fox baiting on private land	Consult with the West Gippsland Catchment Management Authority and the Mornington Peninsula and Western Port Biosphere Reserve Foundation Ltd to identify opportunities to undertake fox baiting on key private land sites	Late 2014	Parks Victoria and DEPI
	Implement any fox baiting on key private land sites	2015 and 2016	Parks Victoria and DEPI

References

Australian Research Centre for Urban Ecology (2012a) *Comparison of management options using Population Viability Analysis for the Southern Brown Bandicoot: Final Report.* Prepared for LMA)

Ecological character description of the Southern Brown Bandicoot in South East Melbourne. A guide to recovery planning (ARCUE, 2012b, in draft)

Ecological character description of the Southern Brown Bandicoot in South East Melbourne. Action Plan (ARCUE, 2012c, in draft).

Brougham & Dickman 1991 [Note, this document is referenced in document but no available online]

Australian Research Centre for Urban Ecology (2010) *Southern Brown Bandicoot Management Plan: Pines Flora and Fauna Reserve. March 2010.* Prepared for the LMA.

Australian Research Centre for Urban Ecology (2011) *Summer and Autumn 2011 sandpad surveys of fox activity levels before and after fox control works at the Pines Flora and Fauna Reserve.* Prepared for the LMA

Biosis Research (2008) *Flora and fauna assessment of The Pines Flora and Fauna Reserve, Frankston, Victoria, Melbourne*.

Brook, B., Cannon, J., Lacy, R., Mirande, C. and Frankham, R. (1999). *A comparison of the population viability analysis packages GAPPS, INMAT, RAMAS and VORTEX for the Whooping Crane (Grus americana). Animal Conservation* 2:23-31.

Brown, G.W. and M.L. Main (2010). Draft National Recovery Plan for the Southern Brown Bandicoot Isoodon obesulus obesulus. Department of Sustainability and Environment Victoria.

Coates T.D. (2008) *The effect of fox control on mammal populations in an outer urban conservation reserve.* Australian Mammalogy. 30, 1-13

Coates T., Nicholls D., Wilig R. (2008) *The distribution of the Southern Brown Bandicoot Isoodon obesulus in south central Victoria.* The Victorian Naturalist.Vol. 125 (5) 128-138

Department of Environment and Conservation (NSW) (2006) *Southern Brown Bandicoot (Isoodon obesulus) Recovery Plan.* NSW DEC, Hurstville NSW.

Department of Sustainability & Environment (2011) *Sub-regional Species Strategy for the Southern Brown Bandicoot - Draft for Public Consultation. Currently under review.*

Ecology Partners (2010a) *The Pines Flora and Fauna Reserve Weed Management Plan.* June 2010. Prepared for the LMA.

Ecology Partners (2010b) *The Pines Flora and Fauna Reserve Revegetation Plan for the Former Orchard Site*. September 2010. Prepared for the LMA.

Haby N., Long K. (2005) *Recovery plan for the southern brown bandicoot in the Mount Lofty Ranges, South Australia, 2004 to 2009.* Department for Environment and Heritage SA, Natural Heritage Trust, Australia.

Linking Melbourne Authority (2010*): The Greater Pines Reserve Master Plan* (2010). Prepared by LMA in conjunction with Parks Victoria, FCC, DSE, and DPI.

Linking Melbourne Authority (2010a) *The Pines Flora and Fauna Reserve Weed Management Plan, June 2010*. Prepared by LMA

Linking Melbourne Authority (2010b) *The Pines Flora and Fauna Reserve Revegetation Plan for the Former Orchard Site, September 2010.* Prepared by LMA

McCaffrey et al. (2010). *Ecological Connectivity Plan for the south-east region of Melbourne*. 26 April 2010. Prepared for DSE.

Menkhorst, P.W. (1995) *Mammals of Victoria* Oxford University Press, Melbourne.

Nicholls, D and Coates, T (2011). *Regional Recovery Plan for the Southern Brown Bandicoot (Isoodon obesulus obesulus) in the Mornington Peninsula and Western Port Biosphere Reserve, Victoria, Australia*. June 2011. Draft for Public Comment.

Parks Victoria (2002). *Linking People and Spaces – A strategy for Melbourne's Open Space Network*, Parks Victoria, Melbourne

Parks Victoria (2003). *Conservation Reserves Management Strategy,* Parks Victoria,

Parks Victoria (2006). *Levels of Protection Framework for Natural Values Management,* Parks Victoria, Melbourne.

Practical Ecology (2010) [Note, this document is referenced in document but no available online]

Southern and Eastern Integrated Transport Authority (2009), *Frankston Bypass Environmental Effects Statement*.

Victorian Government (2010) *Delivering Melbourne's Newest Sustainable Communities*.

Victorian Government (2011) *Southern Metropolitan Region Fire Management Plan,* September 2011.

Appendix 1: Parks Victoria review of predator proof fence feasibility

Appendix 2: Long-term predator control program and monitoring

Appendix 3: Ecological Character Description

Appendix 4: Ecological Character Description – Action Plan

Appendix 5: Monitoring Program

Appendix 6: Biosis Report

Appendix 7: The Pines Flora and Fauna Reserve Revegetation Plan for the Former Orchard Site