



ACT
Government

Territory and Municipal Services

Extension to the Mulligans Flat and Goorooyarroo Nature Reserves

Offset Management Plan

(For the Throsby North, Throsby East and
Kenny Broadacre Offset Areas)

Commitments 10 within the Gungahlin Strategic Assessment Biodiversity
Plan

Final July 2015

**Prepared by Territory and Municipal Services Directorate on
behalf of the ACT Government**

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List of Abbreviations

ACT	Australian Capital Territory
ANU	Australian National University
BoB	The Bush on the Boundary Reference Group
CEMP	Construction Environment Management Plan
CIMAG	Canberra Indian Myna Action Group
COG	Canberra Ornithologist Group
CPR	Conservation Planning and Research unit (under EPD)
DA	Development Application
DoE	Department of the Environment (Commonwealth)
EIS	Environmental Impact Statement
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999 (Cwth)</i>
EPD	Environment and Planning Directorate
GSA	Gungahlin Strategic Assessment
GSA Plan	The Gungahlin Strategic Assessment Biodiversity Plan
LDA	Land Development Agency (under CMTEDD)
MNES	Matters of National Environmental Significance
NC Act	<i>Nature Conservation Act 1980 (ACT)</i>
NSW	New South Wales
OMP	Offset Management Plan
PCS	ACT Parks and Conservation Service
PD Act	<i>Planning and Development Act 2007 (ACT)</i>
PIT	GSA Plan Implementation Team
TAMS	Territory and Municipal Services Directorate
TSR	Travelling Stock Reserves

1. Introduction

1.1 Background

Gungahlin Strategic Assessment

In October 2012, the Australian Capital Territory (ACT) and Commonwealth Governments commenced a Strategic Assessment under Part 10 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The focus of the strategic assessment was to assess the potential impacts from development of the remaining identified greenfield sites in Gungahlin on Matters of National Environmental Significance (MNES) protected under the EPBC Act.

The Gungahlin Strategic Assessment Biodiversity Plan (the GSA Plan) was endorsed on 20 June 2013 and the actions associated with the development were approved on 17 July 2013.

The Plan outlines the commitments made by the ACT Government to avoid, mitigate and offset impacts on MNES and is relevant to the following areas:

- Urban development areas:
 - Kenny
 - Throsby
 - Moncrieff
 - Jacka (north)
 - Taylor
 - Gungahlin Town Centre (east).
- Conservation areas:
 - Additions to Goorooyarroo and Mulligans Flat Nature Reserve (Throsby North, Thorsby East and Kenny Broadacre)
 - Kenny Nature Reserve
 - Kinlyside Nature Reserve
 - Jacka, Taylor and Horse Park North Conservation Areas.

Figure 1 provides an overview of the development and Offset Areas as identified in the GSA Plan.

1.2 Process for Incorporating the Offset Areas into Canberra Nature Park

The extension of the Mulligans Flat and Goorooyaroo Nature Reserves, the creation of the new Kinlyside Nature Reserve and the Jacka, Taylor and Horse Park North Conservation Areas was undertaken by way of a Technical Variation to the Territory Plan. This process was finalised on the 6th November 2014 (Table 1).

Table 1. The establishment of conservation areas via a variation to the Territory Plan

Offset Area	Previous land use	New land use
Throsby North, Throsby East and Kenny Broadacre	Future Urban Area including Residential RZ1 – Suburban zone	Non Urban NUZ3 – Hills, Ridges and Buffer zone with Public Land Overlay Pc – a nature reserve. N.B. Throsby North has extended the Mulligans Flat Nature Reserve. Throsby East and Kenny Broadacre have extended the Goorooyaroo Nature Reserve (Figure 2).
Kinlyside	Residential RZ1 – Suburban zone	Non Urban NUZ3 – Hills, Ridges and Buffer zone with Public Land Overlay Pc – a nature reserve
Jacka	Residential RZ1 – Suburban zone	Non Urban NUZ3 – Hills, Ridges and Buffer zone
Horse Park North	Non Urban NUZ1 – Broadacre	Non Urban NUZ3 – Hills, Ridges and Buffer zone
Taylor	Residential RZ1 – Suburban zone	Non Urban NUZ3 – Hills, Ridges and Buffer zone

The development of Kenny has been delayed due to development constraints identified on the site. Further work is being undertaken by the LDA to determine the most suitable outcomes and development options for this suburb. The Territory Plan Variation did not include Kenny due to the planning uncertainties in this suburb.

1.3 Purpose and Scope

Commitment 10 of the GSA Plan requires the ACT Government to develop Offset Management Plans for new reserves or existing reserves that will be extended to offset the impacts on MNES from the urban development described in the GSA Plan. This Offset Management Plan (the Plan) has therefore been prepared to fulfil commitment 10 in the GSA Plan.

The Plan will:

- guide the implementation of ecological management activities within the Offset Areas to protect and enhance the extent and condition of the White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (Box Gum Woodland) ecological community as well as the habitat and populations of the Golden Sun Moth, Superb Parrot and Striped Legless Lizard. The management actions within this Plan are also consistent with the Habitat Improvement Plans that were produced in accordance with commitment 27 within the GSA Biodiversity Plan (ACT Government 2014a, b, c, d).

- guide the management of conservation values present in Offset Areas that are not listed under the EPBC Act. This includes species listed under the ACT Government *Nature Conservation Act 2014* and heritage values protected under the ACT Government *Heritage Act 2004*.
- guide the development of community recreation and interpretation plans to improve the recreation opportunities and the promotion of the local conservation values to the community.
- contribute towards the planning for the delivery of commitments 28, 30, 31 and 33-36 within the GSA Plan. This includes:
 - establishing a fire hazard management strategy for MNES
 - establishing educational resources for the Throsby residents on the ecological values of the Offset Areas and the activities that are prohibited within the nature reserve complex
 - research on Superb Parrot habitat requirements
 - undertaking control programs of ruderal species
 - undertaking salvage and relocation of structural habitat elements such as logs
 - undertaking plantings to improve connectivity and wildlife movement along Sullivan's creek, targeting in particular superb parrot movement corridors.
 - undertaking all fire management activities in line with ACT Government's Ecological Guidelines for Fuel and Fire Management Operations.

Importantly, this Plan also guides how the management of the conservation values within the Offset Areas will complement or enhance other conservation and research programs within Canberra Nature Park and the adjoining reserves, including the Mulligans Flat Woodland Sanctuary.

Furthermore, Section 1.4 describes how this Plan will contribute towards delivering commitments within other plans and strategies that relate to managing threatened ecological communities and species, the Mulligans Flat and Goorooyarloo Nature Reserves (including the Mulligans Flat Woodland Sanctuary) and more broadly, Canberra Nature Park.

1.4 Strategic Context

The primary objective of establishing the Offset Area is to permanently protect and enhance the extent and quality of the White Box - Yellow Box - Blakely's Red Gum Grassy Woodland community and the populations and habitat of the Striped Legless Lizard, Golden Sun Moth and Superb Parrot. Specific objectives include:

- to improve the condition of areas that meet the listing criteria for the White Box - Yellow Box - Blakely's Red Gum Grassy Woodland as defined under the EPBC Act (EPBC Box Gum Woodland)
- to improve the condition of areas that currently do not meet the EPBC Box Gum Woodland criteria to a condition that meets the listing criteria
- to improve the management of existing habitat to contribute towards the persistence of a viable local population of Golden Sun Moth in northern ACT
- to improve the management of existing and potential habitat in order to support the recovery of the Superb Parrots
- to improve the management of existing habitat to contribute towards the persistence of a viable population of Striped Legless Lizard

This Plan provides a framework for achieving these objectives in a measureable and assessable manner.

The management of the Offset Areas will also contribute towards delivering the commitments within other regional and national plans, strategies and policies relating to:

- the management and recovery of threatened species and ecological communities (including contributing towards the ACT Government’s Action Plans for threatened species and communities and the delivery of established long-term research and monitoring programs)
- the assessment and management of places or objects with heritage value
- addressing priority land management issues (e.g. reducing the impact from invasive plants and animals and mitigating the impact from bushfire)
- the management of the adjoining reserves (including the Mulligans Flat Woodland Sanctuary) and, more broadly
- the management of Canberra Nature Park.

Table 2 provides examples of the plans and strategies that managing the Offset Area will contribute to deliver.

Table 2. Links with regional and national Strategies and Recovery Plans

Strategic Objective	Title
<p>The management and recovery of threatened species and ecological communities (including long-term research and monitoring projects)</p>	<p>ACT Nature Conservation Strategy 2103 – 23 (ACT Government 2013a)</p> <p>Box Gum Woodland The National Recovery Plan for White Box - Yellow Box - Blakely’s Red Gum Grassy Woodland and Derived Native Grassland (Department of Environment, Climate Change and Water NSW 2010) Action Plan No. 27 - ACT Lowland Woodland Conservation Strategy (ACT Government 2004).</p> <p>Mulligans Flat and Goorooyarroo Woodlands Experiment Manning, A. D., Wood, J. T., Cunningham, R. B., McIntyre, S., Shorthouse, D. J., Gordon, I. J. and Lindenmayer, D. B. (2011) Integrating research and restoration: the establishment of a long-term woodland experiment in south-eastern Australia. <i>Australian Zoologist</i> 35(3): 633-648.</p> <p>Golden Sun Moth Action Plan No. 28 – ACT Lowland Native Grassland Conservation Strategy (ACT Government 2005).</p> <p>Superb Parrot National Recovery Plan for the Superb Parrot <i>Polytelis swainsonii</i> (Baker-Gabb 2011) Action Plan No. 27 -ACT Lowland Woodland Conservation Strategy (ACT Government 2004).</p> <p>Striped Legless Lizard National Recovery Plan for the Striped Legless Lizard (<i>Delma impar</i>): 1999-2003 (Smith, W. J. S. & P. Robertson, 1999) [Recovery Plan]. Action Plan No. 28 – ACT Lowland Native Grassland Conservation Strategy (ACT Government 2005).</p> <p>Woodland Birds Action Plan No. 27 -ACT Lowland Woodland Conservation Strategy (ACT Government 2004).</p>
<p>The assessment and management of places or objects with heritage value</p>	<p>ACT Heritage Council Cultural Heritage Reporting Policy (ACT Government 2015b)</p>

Strategic Objective	Title
<p>Addressing land management issues</p>	<p>Invasive Plants ACT Weeds Strategy 2009 – 2019 (ACT Government 2009). <i>Noxious and Environment Weeds Operations Plan (eWOP)</i> – ACT Parks and Conservation Service (updated annually)</p> <p>Invasive Animals Canberra Indian Myna Action Group Strategy (Canberra Indian Myna Action Group 2006) ACT Pest Animal Management Strategy 2012-2022 (ACT Government 2012) <i>Vertebrate Pest Management Operations Plan</i> – ACT Parks and Conservation Service (updated annually)</p> <p>Over-abundant Animals ACT Kangaroo Management Plan (ACT Government 2010)</p> <p>Bushfire Management The ACT Strategic Bushfire Management Plan 2014-2019 (ACT Government 2014e)</p>
<p>Management of adjoining reserves (including the Mulligans Flat Woodland Sanctuary) and Canberra Nature Park</p>	<p><i>Draft Canberra Nature Park Plan of Management 2015-2025</i>. ACT Government (2015a)</p> <p><i>Draft Mulligans Flat Strategic Plan</i> (Woodlands and Wetlands Trust 2014)</p>

1.5 Specific Commitments

The GSA Plan and the Habitat Improvement Plans describe the specific commitments that the ACT Government made towards protecting and managing MNES within the Offset Areas. Table 3 outlines the commitments that are specific to the Throsby North, Throsby East and Kenny Broadacre Offset Areas.

Table 3. Target and management commitments as described in the GSA Biodiversity Plan and Habitat Improvement Plans

Target	Management Commitment	Section No.
Box Gum Woodland		
<ul style="list-style-type: none"> 67 ha of woodland within the Offset Areas which currently do not meet the EPBC Act criteria will meet these criteria over the 20 years of the Plan. Approximately 65 ha of woodland within the Offset Areas with an average condition quality score of “6” will be improved to a higher average quality score (As scored by Umwelt 2013). Improve woodland quality for existing reserves and additional areas added to nature reserve as measured by: <ul style="list-style-type: none"> increasing the diversity of understorey species for vegetation conforming to the community definition currently mapped within the Offset Areas as being of moderate to poor quality. increasing the extent of vegetation that conforms to the definition of the listed community whether in the woodland form or derived native grassland form. 	<ul style="list-style-type: none"> Salvage and relocation of structural habitat elements such as fallen logs, to enhance habitat of woodland fauna Undertake plantings to improve connectivity and wildlife movement along Sullivan’s creek, targeting Superb Parrot movement corridors in particular Manage regeneration in a way that does not compromise the viability of populations of protected matters which rely on derived native grasslands. Maintain or enhance populations of Golden Sun Moth, Striped Legless Lizard and Superb Parrots utilising woodland areas Provide suitable habitat for threatened woodland species re-introduced to Mulligans Flat Woodland Sanctuary (e.g. Bush Stone Curlew (<i>Burhinus grallarius</i>) or New Holland Mouse (<i>Pseudomys novaehollandiae</i>)). 	<p>Section 4.1.6</p> <p>Section 4.1.3</p> <p>Section 4.1.2</p> <p>Section 3.5.2</p>
Golden Sun Moth		
<ul style="list-style-type: none"> No net reduction over the life of the GSA Plan in areas occupied by Golden Sun Moth within the Strategic Assessment area. Improve the quality of 120 hectares of Golden Sun Moth habitat Encourage the Golden Sun Moth to colonise areas along the proposed unreserved urban fringe where appropriate and practicable. 	<ul style="list-style-type: none"> Management of secondary grassland where the species occurs within a matrix of regenerating Box Gum Woodland Control ruderal species such as the European Wasp (<i>Vespula germanica</i>), which may prey on Golden Sun Moth, the Common Myna (<i>Acridotheres tristis</i>), the Noisy Miner (<i>Manorina melanocephala</i>) and stray or feral cats. 	<p>Section 4.1.1</p> <p>Section 4.3.2</p>
Superb Parrot		
<ul style="list-style-type: none"> Improved management of existing and potential habitat in order to support the recovery of Superb Parrots 	<ul style="list-style-type: none"> Revegetate or assist natural recruitment of species that may eventually form hollow trees in areas likely to be suitable as future nesting 	<p>Sections 4.1.2 and 4.1.3</p>

Target	Management Commitment	Section No.
<ul style="list-style-type: none"> Improved understanding of Superb Parrot habitat and breeding requirements 	<p>sites</p> <ul style="list-style-type: none"> Prevent stock from causing localised compaction and concentration of nutrients around existing large trees, to aid long term tree survival Place low intensity land uses in areas that might otherwise result in disturbance to species during critical life-cycle stages, e.g. Superb Parrot breeding Control ruderal species such as the Common Myna (<i>Acridotheres tristis</i>) and stray or feral cats. Undertake plantings to improve connectivity and wildlife movement along Sullivan’s creek, targeting Superb Parrot movement corridors in particular. Research that may include <ul style="list-style-type: none"> Research to improve the understanding of habitat requirements for foraging and dispersing Superb Parrots within the peri-urban and urban environments. Research to improve the understanding of the Superb Parrot population that occurs in the northern ACT (especially in terms of nest site fidelity and breeding success). 	<p>Section 4.1.1 and 4.1.7</p> <p>Section 4.1.1</p> <p>Section 4.3.2</p> <p>Section 4.1.3</p> <p>Section 7</p>
Striped Legless Lizard		
<ul style="list-style-type: none"> No net reduction in the area occupied by Striped Legless Lizard within the Offset Areas Improve the quality of seven hectares of Stripe Legless Lizard habitat 	<ul style="list-style-type: none"> Improve habitat through conservation grazing, weed control, invasive animal control etc 	<p>Sections 4.1.1, 4.3.1 and 4.3.2</p>

1.6 Roles and Responsibilities

Table 4 describes the stakeholders involved in delivering the commitments within the GSA Plan.

Table 4. Roles and responsibilities for implementing the Offset Management Plan

Title	Role	Responsibilities
Plan Implementation Team	Oversee the implementation and compliance of the GSA Plan (Umwelt 2013b)	<ul style="list-style-type: none"> • ensure actions undertaken comply with the commitments within the GSA Plan • ensure activities funded are consistent with the business rules established in the PIT Charter (Umwelt 2013b) • ensure actions are undertaken in a transparent and accountable manner • consult with stakeholders regarding activities undertaken under the Plan • provide advice to other parties regarding their responsibilities under the Plan (Umwelt 2013b).
TAMS - Parks and Conservation Service	Custodian and manager of Offset Areas and adjoining reserves (including the Mulligans Flat Woodlands Sanctuary). Develop and implement fire management plans to manage bushfire fuels and limit the spread of fire on and from land managed by ACT Parks and Conservation Service.	<ul style="list-style-type: none"> • implement this Plan • use the results of the monitoring program to evaluate and refine management actions within this Plan • periodically review progress against condition improvement targets • ensure all internal and external reporting requirements are met • ensure that all relevant records are effectively maintained • ensure that staff and contractors are appropriately qualified, licensed and experienced to undertake the tasks described in this Plan • provide training and support for volunteer Park Care (Friends of Mulligans Flat) activities • Advise and assist to develop and implement the Bushfire Hazard Management Strategy (section 5)

Title	Role	Responsibilities
EPD - Conservation Planning and Research	Conducts research on local flora and fauna, prepares scientific advice on ecological and natural resource management, conducts ecological surveys, biodiversity monitoring, and prepares and guides the implementation of threatened species recovery plans and the reintroduction of rare species into the ACT.	<ul style="list-style-type: none"> • Develop a plan to implement research on the MNES protected within the Offset Areas. • Co-ordinate research projects that require the services of external providers • Provide advice and assist to deliver research projects where the ACT Government are the delivery agents • Assist TAMS staff to interpret results from MNES monitoring programs and provide recommendations on how to adjust land management strategies as is required to deliver the commitments in the GSA Plan and in line with the adaptive management strategy (section 9) • Provide advice, as is required by TAMS staff, on the on-going management of the conservation values within the Offset Areas.
Mulligans Flat Woodland Sanctuary Sub-Committee	The Mulligans Flat Woodland Sanctuary Sub-Committee is a sub-committee of the Woodlands and Wetlands Trust. It contributes expert and community advice on the management of Mulligans Flat and related areas, in partnership with the ACT Parks and Conservation Service. A Species Management Panel and other specialist groups assist the Sub-Committee.	<ul style="list-style-type: none"> • Support for Friends of Mulligans Flat • Provides expert and community advice to TAMS staff on the management of the conservation values within the Offset Areas • Contribute towards the development of the research plan. • Will refer issues to the species management panel or other specialist groups, when asked by TAMS staff.
Mulligans Flat and Goorooyaroo Research Committee	Coordinates research activities and facilitates liaison between researchers involved in the Mulligans Flat-Goorooyaroo Woodlands Experiment. Members include representatives from the ANU, ACT Government and CSIRO.	<ul style="list-style-type: none"> • Contribute towards the planning and delivery of research projects on the MNES protected within the Offset Areas.
Land Development Agency	Developer of the Throsby residential area.	<ul style="list-style-type: none"> • Planning access into Offset Areas during and post construction • Re-locate of woody debris from development areas into the Offset Areas, with advice from TAMS/CPR • Provide biodiversity education and awareness activities for Throsby residents as part of the Mingle program, in conjunction with the Mulligans Flat TAMS.

1.7 Statutory Bodies and Community Consultation

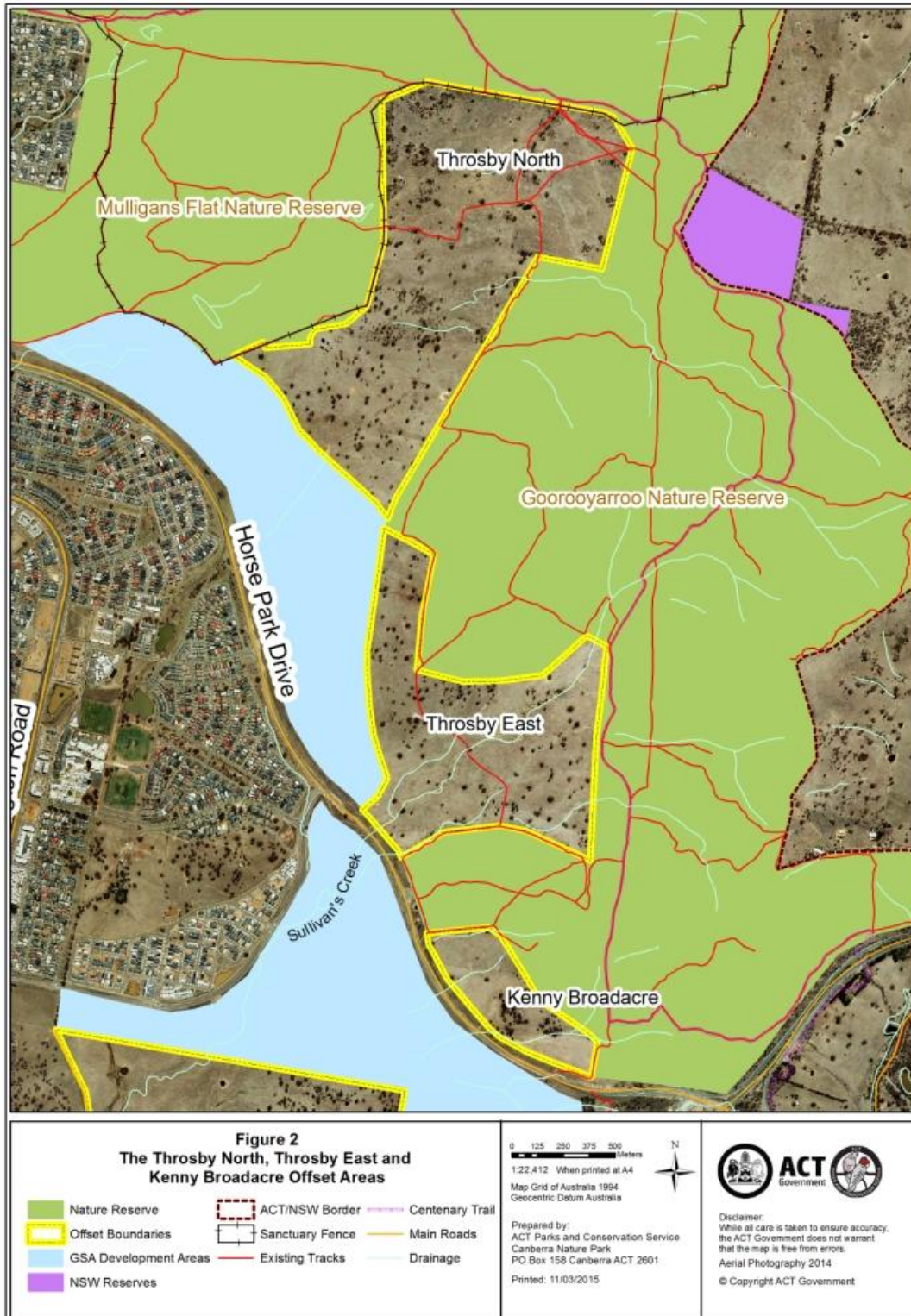
This Plan has been prepared in consultation with the Gungahlin Strategic Assessment Working Group, additional ACT Government representatives from the TAMS Parks and Territory Services Division (including PCS region staff and the Fire Management Unit) and Conservation Planning and Research, the Mulligans Flat Woodland Sub-Committee and the ACT Conservation Council.

This final Plan was approved by the Plan Implementation Team prior to submission to the Commonwealth.

2. Description of the Offset Areas

The Offset Areas include Thorsby North (172 hectares), Thorsby East (104 hectares) and Kenny Broadacre (23 hectares) and extend both the Mulligans Flat and Gorooyarroo Nature Reserves. The Offset Areas adjoin the Thorsby residential development area and are adjacent to the future Kenny residential development and Kenny Offset Area (Figure 2).

Figure 2. The Offset Areas



2.1 Connectivity

Throsby North currently adjoins the Mulligans Flat Woodland Sanctuary. Section 4.2.1 provides further information on the extension of the Sanctuary to incorporate the Offset Areas.

Contiguous with the Goorooyaroo Nature Reserve is an additional 24 hectares that is managed by NSW National Parks and Wildlife Service (Figure 2). This reserve is part of a larger reserve also named Goorooyaroo Nature Reserve.

Combined with other woodlands within northern ACT and adjacent NSW, the Offset Areas form one of the largest, best connected and most diverse patches of Box Gum Woodland remaining in south-eastern Australia (Figure 3). The area is also part of the Molonglo River to Barton Highway Woodland corridor, which has been nominated for provisional registration on the ACT Heritage List for its natural heritage values.

The source of Sullivan's Creek is within the Throsby East Offset Area. The Creek flows from within the reserve through to the Kenny Offset Area and is a tributary of Lake Burley Griffin and the Molonglo River (Figure 3).

2.2 Conservation Significance

The Offset Areas are of high conservation significance, supporting the critically endangered White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland ecological community, the critically endangered Golden Sun Moth (*Synemon plana*), the vulnerable Superb Parrot (*Polytelis swainsonii*) and the vulnerable Striped Legless Lizard (*Delma impar*).

The Throsby North and Throsby East Offset Areas contain over half of the Superb Parrot nesting sites in the ACT (Figure 4) (ACT Government 2014a). They also support approximately 166 hectares of Golden Sun Moth habitat (Figure 5) and about 163 hectares of EPBC Box Gum Woodland, which is important breeding habitat for threatened and declining woodland birds (Figure 6).

Kenny Broadacre supports a further nine hectares of EPBC Box Gum Woodland and approximately seven hectares of Striped Legless Lizard habitat (Figure 7).

Other threatened species listed in the ACT including the White-winged Triller (*Lalage sueurii*), Varied Sittella (*Daphoenositta chrysoptera*), Regent Honeyeater (*Anthochaera Phrygia*) and Swift Parrot (*Lathamus discolor*) have been recorded in the Offset Areas or in adjacent reserves.

The Hooded Robin (*Melanodryas cucullata*) and Brown Treecreeper (*Climacteris picumnus*), which have both been recorded in the Mulligans Flat and Goorooyaroo Nature Reserves, are now believed to be locally extinct (J. Bounds 2015, pers. comm.).

Latham's Snipe (*Gallinago hardwickii*), a migratory species protected under the EPBC Act, has also been sighted in the area. The Canberra Ornithologists Group regularly records the Latham's Snipe around dams and wet drainage lines and particularly around the large dam in the Mulligans Flat Nature Reserve, adjacent to the Throsby North offsets area (J Bounds 2015, pers. comm.)

The northern section of the Throsby North Offset Area has the highest diversity of native flora compared to the remaining Offset Areas. It is a high quality box gum woodland, that is similar in quality to areas currently in the Mulligans Flat Nature Reserve. This is a focus area for the Friends of the Mulligans Flat ParkCare Group. Three plant species considered rare in the ACT occur in this offset area. The plants are Narrow Plantain (*Plantago gaudichaudii*), Blue Grass Lily (*Caesia calliantha*) and Hairy Centrolepis (*Centrolepis strigosa*) (Canberra Nature Map 2015).

The Offset Areas also support important sites of cultural (indigenous and historic) heritage.

Figure 3. Landscape Connectivity

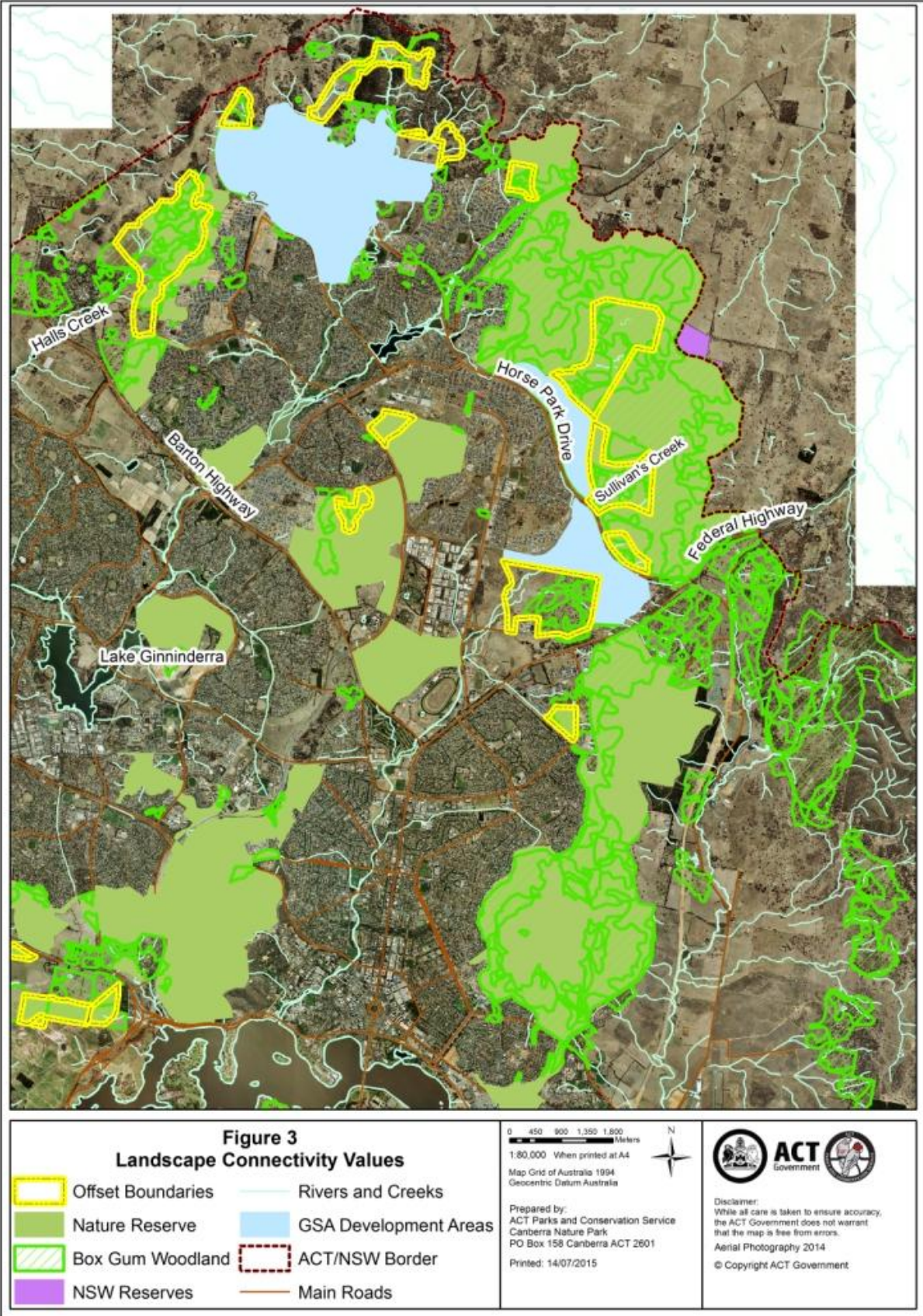


Figure 4. Superb Parrot nesting sites and observations within the offset areas and adjoining reserves

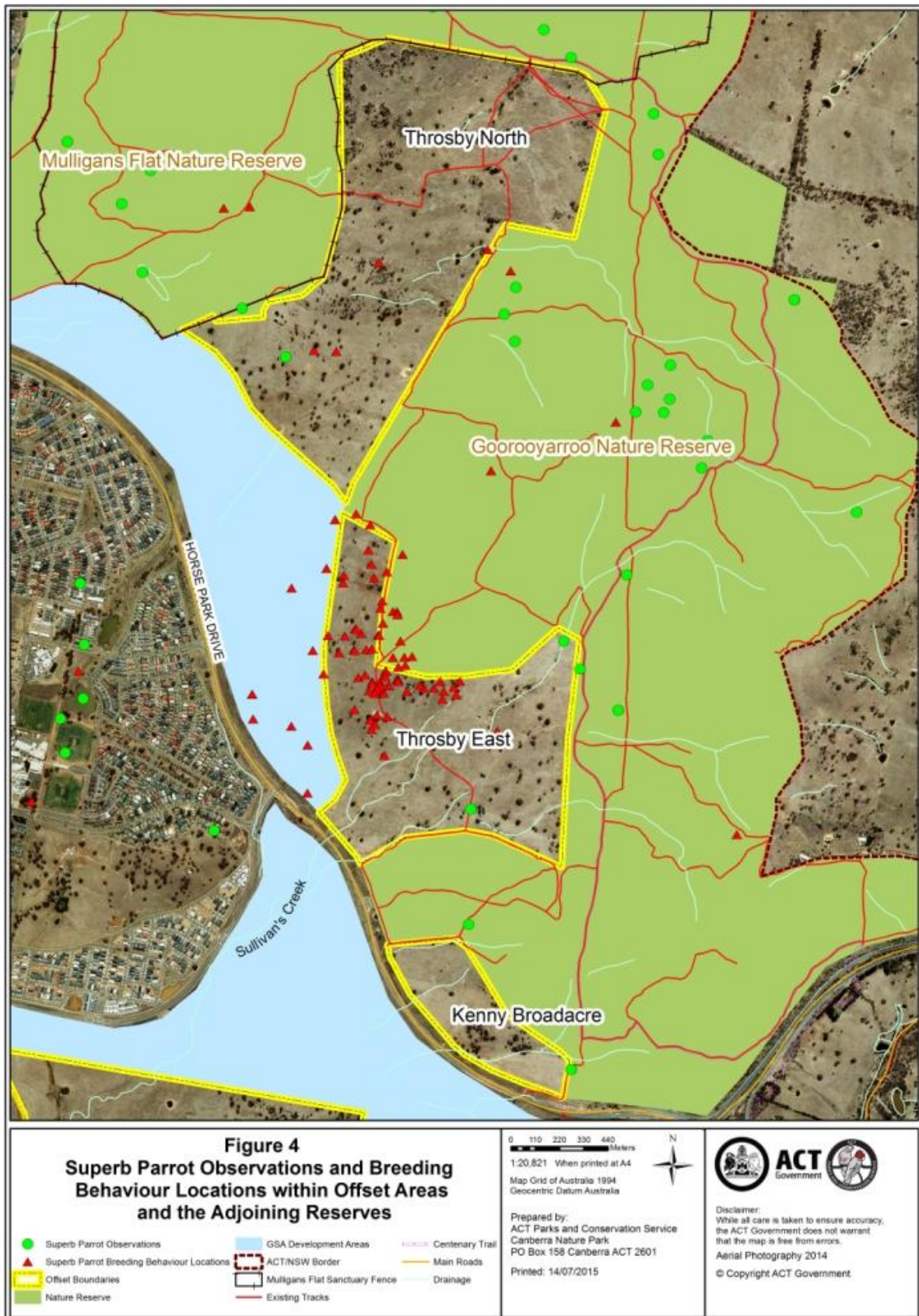


Figure 5. Extent of Golden Sun Moth habitat within the offset areas and adjoining reserves

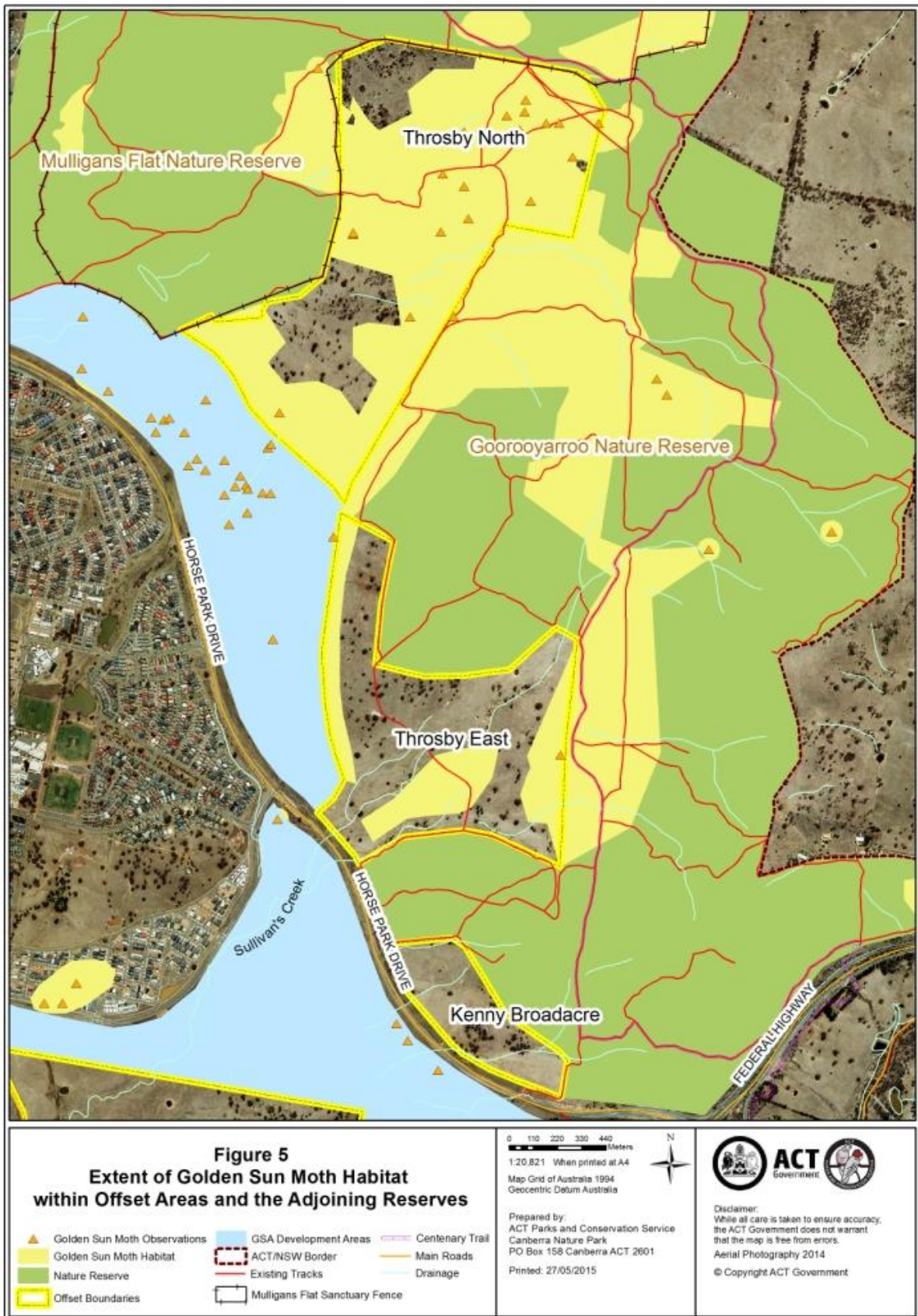


Figure 6. Quality and extent of EPBC Box Gum Woodland within the offset areas and adjoining reserves



Figure 7. Striped Legless Lizard habitat within the offset areas and adjoining reserves



2.3 Significant Communities

Table 5. Threatened ecological communities in the Offset Areas

Ecological Community	Commonwealth*	ACT**	NSW***
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	Critically endangered	endangered	endangered

*Australian Government Environment Protection and Biodiversity Conservation Act 1999

**Nature Conservation Act 2014 (ACT)

***National Parks and Wildlife Act 1974 (NSW)

2.4 Significant Species

2.4.1 Fauna

Table 6. Threatened fauna in the Mulligans Flat and Goorooyarro Nature Reserves (and Offset Areas)

Scientific Name	Common Name	Commonwealth*	ACT**	NSW***	Notes
<i>Anthochaera Phrygia</i>	Regent Honeyeater	critically endangered	endangered	critically endangered	COG [#] records in the Mulligans Flat and Goorooyarro Nature Reserves, however no records specifically in the Offset Areas.
<i>Calyptorhynchus lathamii</i>	Glossy black Cockatoo		vulnerable	vulnerable	No known records in the Mulligans Flat or Goorooyarro Nature Reserves. Drooping She-oaks (<i>Allocasuarina verticillata</i>), which are a critical feed tree, occur in the southern sections of Goorooyarro.
<i>Chthonicola sagittata</i>	Speckled Warbler			vulnerable	COG [#] records in Mulligans Flat and Goorooyarro Nature Reserves. Not common.
<i>Daphoenositta chrysoptera</i>	Varied Sittella		vulnerable	vulnerable	Observed in Throsby Offset Area in 2013 (M. Mulvaney pers. comm. 2105). COG [#] records in Mulligans Flat and Goorooyarro Nature Reserves. Not common.

Scientific Name	Common Name	Common-wealth*	ACT**	NSW***	Notes
<i>Climacteris picumnus</i>	Brown Treecreeper		vulnerable	vulnerable	Small numbers previously recorded by COG [#] in Mulligans Flat and Gorooyarroo Nature Reserves. The last record was in 2005 in the southern sections of Gorooyarroo. They are now believed to be locally extinct. There are recent records in the Hall TSR in northern Gungahlin.
<i>Delma impar</i>	Striped Legless Lizard	vulnerable	vulnerable	vulnerable	
<i>Gallinago hardwickii</i>	Lathams' Snipe	Migratory species			
<i>Grantiella picta</i>	Painted Honeyeater		vulnerable	vulnerable	COG [#] records in Mulligans Flat and Gorooyarroo Nature Reserves, particularly in wooded patches with abundant mistletoe. Has also been recorded in northern part of Throsby North Offset Area
<i>Hieraetus morphnoides</i>	Little Eagle	-	vulnerable	vulnerable	Historical records in the Mulligans Flat and Gorooyarroo Nature Reserves. The Nature Reserves (including the Offset Areas) and the surrounding land, provide suitable habitat.
<i>Lalage sueurii</i>	White-winged Triller		vulnerable	vulnerable	COG [#] record. A regular, spring/summer migrant. Breeds in Mulligans Flat and Gorooyarroo Nature Reserves Has also been recorded in northern part of Throsby North Offset Area.

Scientific Name	Common Name	Common-wealth*	ACT**	NSW***	Notes
<i>Lathamus discolor</i>	Swift Parrot	endangered	vulnerable	vulnerable	Rare species recorded occasionally in ACT woodland areas on seasonal migration (autumn-winter). COG [#] reported one record within Mulligans Flat Nature Reserve.
<i>Melanodryas cucullata</i>	Hooded Robin		vulnerable	vulnerable	Previous COG [#] records in Mulligans Flat and Gorooyarroo Nature Reserves. Now believed to be locally extinct.
<i>Perunga ochracea</i>	Perunga Grasshopper		vulnerable		Recorded in the Bonner Offset Area that also extends the Mulligans Flat Nature Reserve.
<i>Petroica boodang</i>	Scarlet Robin	-	vulnerable	vulnerable	A declining species in the ACT. Mulligans Flat is a regional stronghold for the species, especially in winter.
<i>Polytelis swainsonii</i>	Superb Parrot	vulnerable	vulnerable	vulnerable	Regularly recorded (spring/summer season) in Mulligans Flat and Gorooyarroo Nature Reserves, including within the Offset Areas. Also regularly seen flying over into NSW (to feed) and across Gungahlin, especially Harrison. The Offset Areas support a major breeding site.
<i>Stagonopleura guttata</i>	Diamond Firetail			vulnerable	A declining species in the ACT. Also declining in the local area. There are a few recent records for Gorooyarroo Nature Reserve.
<i>Synemon plana</i>	Golden Sun Moth	critically endangered	endangered	endangered	

*Australian Government Environment Protection and Biodiversity Conservation Act 1999

**Nature Conservation Act 2014 (ACT)

***National Parks and Wildlife Act 1974 (NSW)

Canberra Ornithologists Group

2.4.2 Flora

Table 7. Threatened flora in the Offset Areas and adjoining reserves

Scientific Name	Common Name	Commonwealth*	ACT**	NSW***	Notes
<i>Plantago gaudichaudii</i>	Narrow Plantain		rare		Several hundred plants in Throsby North
<i>Caesia calliantha</i>	Blue Grass Lily		rare		A few plants in Throsby North
<i>Centrolepis strigosa</i>	Hairy Centrolepis		rare		About 50 plants in Throsby North

*Australian Government Environment Protection and Biodiversity Conservation Act 1999

**Nature Conservation Act 2014 (ACT)

***National Parks and Wildlife Act 1974 (NSW)

Refer to Appendices A and B for a complete list of fauna and flora recorded in the Offset Areas and the rest of the Mulligans Flat and Goorooyarroo Nature Reserves.

2.5 Land Use History

There is abundant evidence of Aboriginal land use within the Gungahlin area prior to European settlement. European settlement within the area dates back to the early nineteenth century, with sheep grazing with shepherds commencing in 1826. From 1860 on, fences were constructed and continuous stocking with sheep commenced in large paddocks. Some pasture improvement was undertaken. Large old and dead trees were felled for firewood for the Canberra market from 1920-1925 (Thackway 2012).

In 1994, Mulligans Flat Nature Reserve was established. Continuous stocking and firewood collection ceased within the reserve at this time. Gorooyaroo Nature Reserve was established in 2004.

The Mulligans Flat Woodland Sanctuary was established in 2008. In 2009 a predator proof fence was erected and a program to remove pest plant and animal species from within the Sanctuary commenced.

With the exception of Block 734, the areas adjacent to the Mulligans Flat and Gorooyaroo Nature Reserves (the Offset Areas) continued to operate as sheep and cattle grazing properties until January 2014, when they were incorporated into the ACT Reserve System. These blocks are now subject to an agistment license, which conditionally permits sheep and cattle grazing for conservation purposes.

Block 734, located at the head of Throsby North, was resumed by the Territory and managed as unleased Territory land. It now also forms part of the Mulligans Flat Nature Reserve.

Further information on the cultural heritage of Gungahlin area is found in *A Short History of Gungahlin* (Cooke 2010) and includes details on remaining cultural sites.

2.6 Cultural Heritage Values

2.6.1 Aboriginal Cultural Heritage

Aboriginal artefact scatters that have been recorded within the Offset Areas are listed on the ACT Heritage Register. It is likely that many other aboriginal artefacts, which have not previously been recorded are also present.

2.6.2 Historic Heritage

Mulligans Flat Ploughlands and Enclosure of Elms

The Mulligans Flat Ploughlands are located in the south-west of the Throsby North Offset Area (Figure 8). The Mulligans Flat Ploughlands are significant evidence of the cultivation within the area before the advent of tractors. The evidence of ridge and furrow features at the site is well conserved in comparison with most other ploughlands in the ACT and clearly indicates the nature of the agricultural activity. Of the 65 ploughlands sites that once existed in the ACT, the Mulligans Flat Ploughlands is one of five that are sufficiently intact to demonstrate the farming process and way of life that they represent (Pearson 2012).

Within the field is a rectangular enclosure of elms, which may have been a hut site or a sheltered yard (Pearson 2012).

The Mulligans Flat Ploughlands and enclosure of elms are listed on the ACT Heritage Register.

Old Coach Road

The Old Coach Road is also on the ACT Heritage Register. The Old Coach Road runs through the Mulligan Flat Sanctuary northwest of the Throsby North Offset Area (Figure 8). The road was constructed in 1880 and was the main route to link the early rural settlements in the Canberra region to the railway at Bungendore (Cooke 2010).

Inglewood Homestead

Inglewood Homestead is situated in Block 734 within Throsby North Offset Area (Figure 8). The homestead was built in about 1893 by Joseph Winter and was then occupied until 1925 when it subsequently fell into ruin (Cooke 2010). The remains include the stone chimney, scatters of bricks and stone and a remnant pear and plum tree orchard (Cooke 2010).

A heritage assessment has not been completed for this site and it is not currently included on the ACT Heritage Register.

Table 8. Identified heritage places and objects within the Offset Areas

ACT Heritage Register		
Place	Status	Description
Aboriginal		
Aboriginal Places in the Gungaharra Creek Catchment	Registered	Aboriginal artefact scatter
Aboriginal Places in Canberra Nature Park Firetrails	Registered	
Aboriginal Places in the District of Gungahlin	Registered	Aboriginal artefact scatters and isolated finds.
Historic Heritage		
Historic site	Registered	Mulligans Flat Ploughlands and Enclosure of Elms.
Historic site	Registered	Old Coach Road
Historic site	Not registered	Inglewood Homestead

Figure 8. Historic Cultural Heritage Values within the Offset Area



2.7 Recreation Values

Mulligans Flat and Gorooyarroo Nature Reserves are used for walking, running and cycling. Bird watching is also very popular. Ranger guided activities are organised within the Mulligans Flat Woodland Sanctuary.

Access for recreation may be reduced at times when stock are present within the Offset Areas.

Dogs and horses are not permitted within the reserves.

Section 4.5.1 provides further information on the proposed recreation opportunities within the Offset Areas and adjacent reserves.

2.8 Mulligans Flat–Gorooyarroo Woodland Experiment and the Mulligans Flat Woodland Sanctuary

The Mulligans Flat and Gorooyarroo Nature Reserves is the site of a research project of international importance. Commencing in 2004, the [Mulligans Flat-Gorooyarroo Woodland Experiment](#) is a long-term research project that was established in partnership by the ACT Government, the Australian National University, CSIRO and associated collaborators. The research aims to provide a whole-of-ecosystem understanding of Box Gum Woodlands, particularly in relation to ways of restoring the structure and function of temperate woodlands to increase biodiversity.

In 2009, the ACT Government built an 11.5 kilometre, feral animal-proof fence around Mulligans Flat to allow removal and/or control of feral cats, foxes, rabbits and hares, and the introduction of locally extinct species. The '[Mulligans Flat Woodland Sanctuary](#)' provides a valuable opportunity to experimentally reintroduce locally extinct species, observe effects of the experimental management in the absence of cats and foxes, and understand the effects of the reintroduction of locally extinct species that are considered to be 'ecosystem engineers' (Jones *et al.* 1994; Manning *et al.* 2011, Mulvaney 2012).

As part of the experiment, woody debris was brought into the research area to increase habitat diversity and four threatened species, the Brown Treecreeper (*Climacteris picumnus*), Eastern Bettong (*Bettongia gaimardi*, New Holland Mouse (*Pseudomys novaehollandiae*) and Bush Stone-curlew (*Burhinus grallarius*) were introduced into the Sanctuary. There are currently plans to release seven additional species; the Eastern Quoll (*Dasyurus viverrinus*), Brush-tail Phascogale (*Phascogale tapoatafa*), Southern Brown Bandicoot (*Isoodon obesulus*), Long-nosed Bandicoot (*Perameles nasuta*), Diamond Python (*Morelia spilota*), Yellow-footed Antechinus (*Antechinus flavipes*) and Eastern Chestnut Mouse (*Pseudomys gracilicaudatus*).

Within Gorooyarroo Nature Reserve additional research on arthropod assemblages and monitoring plots to trials different fire regimes is also been undertaken.

The ACT Government supports the extension of the Mulligans Flat Woodland Sanctuary, which will incorporate the Throsby North, Throsby East and Kenny Broadacre Offset Areas. The Woodlands and Wetlands Trust are currently working towards securing the additional resources required to extend the predator proof fence.

2.9 Community Engagement

Friends of Mulligans Flat

The 'Friends of Mulligans Flat' was established in late 2011 as part of the Mulligans Flat Woodland Sanctuary Sub-Committee and form part of the Parkcare network of community volunteers. Their focus is primarily to undertake activities within the Mulligans Flat Woodland Sanctuary.

Friends participate in the following:

- quarterly work parties focusing on weed control, erosion control and asset maintenance
- individual weed control, rabbit monitoring and litter control of allocated areas

- assisting researchers with monitoring, feeding and maintenance of infrastructure associated with the re-introduction of locally extinct species such as Bettongs and Bush Stone Curlews
- the Friends also co-ordinate a number of community events including bird walks, wildflower walks and film and information evenings.

The Mulligans Flat Woodland Sanctuary Management Sub-Committee encourages local residents and other members of the community to support the Sanctuary and its programs by volunteering to become a member of 'The Friends of Mulligans Flat'.

There is currently no Parkcare group operating within the Goorooyaroo Nature Reserve, however, the Mulligans Flat Woodland Sub-Committee support the Friends of Mulligans Flat extending its area of interest to include the Goorooyaroo Nature Reserve and the Offset Areas.

Canberra Ornithologists Group

The Canberra Ornithologists Group undertakes regular bird surveys within both Mulligans Flat and Goorooyaroo Nature Reserves. Surveys are seasonal, four times a year at 24 sites in Mulligans Flat and 18 sites in Goorooyaroo. This is part of a long-term woodland bird monitoring project across 142 sites at 15 locations in ACT Grassy Woodlands (J. Bounds 2015, pers. comm.). Records go back to 1995, when surveys commenced in Mulligans Flat.

Bush on the Boundary

The Gungahlin Bush on the Boundary (BoB) Reference Group provides a forum for information exchange, knowledge sharing and sharing of resources that assist biodiversity conservation at the urban bush interface. The BoB was established in response to the proposed development of the new suburbs of Forde and Bonner adjoining the Mulligans Flat Nature Reserve, and has since expanded its area of interest to other developing areas in Gungahlin, including Throsby.

ACT Waterwatch and Frogwatch

The upper reaches of Sullivans and Ginninderra Creeks are monitored as part of the ACT Waterwatch Catchment Health Indicator Program. Frogwatch monitoring activities are also undertaken in Mulligans Flat Nature Reserve.

Sections 4.5.2, 4.5.3 and 4.5.4 describes how the community will continue to be engaged in conserving the conservation values within the Offset Areas and adjacent reserves.

3. Conservation Values

3.1 White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland

Distribution: Figure 6 illustrates the distribution of the Box Gum Woodland within the Offset Areas.

3.1.1 Description

The White Box-Yellow Box- Blakely's Red Gum Grassy Woodland and Derived Native Grasslands ecological community can occur either as woodland or derived native grassland (i.e. grassy woodland where the tree overstorey has been removed). It is characterised by a species-rich understorey of native tussock grasses, herbs and scattered shrubs (where shrub cover comprises less than 30% cover), and a dominance or prior dominance of White Box (*Eucalyptus albens*) and/or Yellow Box (*E. melliodora*) and/or Blakely's Red Gum (*E. blakelyi*) trees. In the woodland state, tree cover is generally discontinuous and of medium height with canopies that are clearly separated.

To be considered part of the listed ecological community remnant areas must also:

- have a predominantly native understorey where at least 50 percent of the perennial vegetation cover in the ground layer is made up of native species; and
- be 0.1 hectare or greater in size contain an understorey with at least 12 native understorey species other than grasses, as well as at least one listed important species; **or**
- be 2 hectares or greater in size, and has an average of 20 or more mature trees per hectare or displays evidence of natural regeneration of mature trees. Mature trees are defined as those with a height of at least 130 centimetres and circumference of 125 centimetres. Regeneration must consist of naturally occurring juveniles of dominant overstorey species with a height of 130 centimetres above ground and circumference of at least 15 centimetres (Department of Environment, Climate Change and Water NSW 2010).

The structure of the Box Gum Woodland varies across the Offset Areas. Some patches exhibit a canopy and/or a regenerating canopy, dominated by Yellow Box (*E. melliodora*) and Blakely's Red Gum (*E. blakelyi*). Other patches occur as a derived native grassland dominated primarily by Spear Grass (*Austrostipa bigeniculata* and *A. scabra*), Wallaby Grass (*Rytidosperma racemosum*), Red-leg Grass (*Bothriochloa macra*) and Kangaroo Grass (*Themeda australis*) (Appendix A).

The quality and diversity of the understorey also varies across the Offset Areas (Eco Logical Australia Pty Ltd 2011). Some areas exhibit a high diversity of native forbs and herbs including Common Everlasting (*Chrysocephalum apiculatum*), Lemon Beauty-heads (*Calocephalus citreus*), Nodding Chocolate Lily (*Dichopogon fimbriatus*), Twining Glycine (*Glycine clandestina*) and Australian Bluebell (*Wahlenbergia gracilis*). Other areas have a high cover of exotic species, including Phalaris (*Phalaris aquatica*), Cocksfoot (*Dactylis glomerata*), Sheep Sorrel (*Acetosella vulgaris*), Fleabane (*Conyza* sp.) and Spear thistle (*Cirsium vulgare*). Patches of exotic species occur in moderate to high abundance in areas where grazing is relatively higher or where there has been greater disturbance from agricultural land management activities (Eco Logical Australia 2011a).

Based on the quality of the vegetation within the Offset Areas Umwelt (2013a) determined that there are two main condition classes of Box Gum Woodland within the Offset Areas. These are:

1. woodland that currently meets the classification of Box Gum Woodland under the EPBC Act
2. woodland that currently does not meet the classification of Box Gum Woodland under the EPBC Act (but does meet the classification of Box Gum Woodland under the NC Act), and which is capable of being enhanced to a condition that would meet the classification criteria (Figure 9 and Table 9).

A commitment within the GSA Plan is to increase the current area of EPBC Box Gum Woodland within the Throsby North, Throsby East and Kenny Broadacre Offset Areas by 67 hectares over 20 years. This

will be achieved using a variety of management techniques such as weed control, promoting natural regeneration and / or revegetating with indigenous species to reach the benchmark or pre-disturbance condition (tree cover 15-30%, 40 -70% native grass cover, 1-5% shrub cover) and improving habitat quality and structural diversity with the relocation of woody debris (fallen timber) into the Offset Area (benchmark for woody debris is 35m of timber with a diameter greater than 10cm per 0.1 ha).

Table 9. Extent of the two Box –Gum Woodland condition types within the Offset Areas and adjacent reserves

Land Type	Area of EPBC Box Gum Woodland (ha)	Area of non EPBC Box Gum Woodland (ha)
Existing Reserve	1143	0
Offset Areas	172	67

Figure 9. Box Gum Woodland quality classes- adapted from Umwelt (2013b)



3.2 Golden Sun Moth (*Synemon plana*)

Current Distribution: Figure 5 illustrates the distribution of the Golden Sun Moth habitat within the Offset Areas. These areas have been rated at different habitat quality levels (Ecological Australia 2011b) (Figure 10).

3.2.1 Description and Life Cycle

The Golden Sun Moth is a medium sized moth with green eyes, clubbed antennae and no functional mouth parts. They have a wingspan of 3 – 3.5 cm and a tapered abdomen. Males are slightly larger than females. Male and female moths are distinguished by their wing colours, with the females having the characteristic golden hind wings (Mulvaney 2012).

The Golden Sun Moth has two discrete life stages: the larvae stage and the adult stage. The larvae stage appears to last for two to three years until they grow to a sufficient size to form pupae. Larvae pupate into adult moths and emerge to breed between mid October to early January (the flight season). Adult Golden Sun Moths have a life span of only a few days. This is due to the lack of functional mouth parts which prevents them from feeding. Their short life span is dedicated to searching for a mate and breeding (Mulvaney 2012).

During the flight season adult moths emerge in cohorts. The largest cohorts of male moths can usually be observed flying about 1 metre above the ground during the warmest parts of the day (10am to 2pm above 20°C) and when cloud cover and wind are minimal (ACT Government 2014c).

Female moths are more sedentary, positioning themselves on the ground in conspicuous locations to attract males. Females walk between tussocks laying 100-200 eggs on the grass tillers or between the tillers and the soil (ACT Government 2005 and ACT Government 2014c).

Golden Sun Moth eggs hatch after a few weeks and the larvae move underground to feed on the roots of the grasses. The pupae develop into adult moths over a period of several weeks (Hogg 2010).

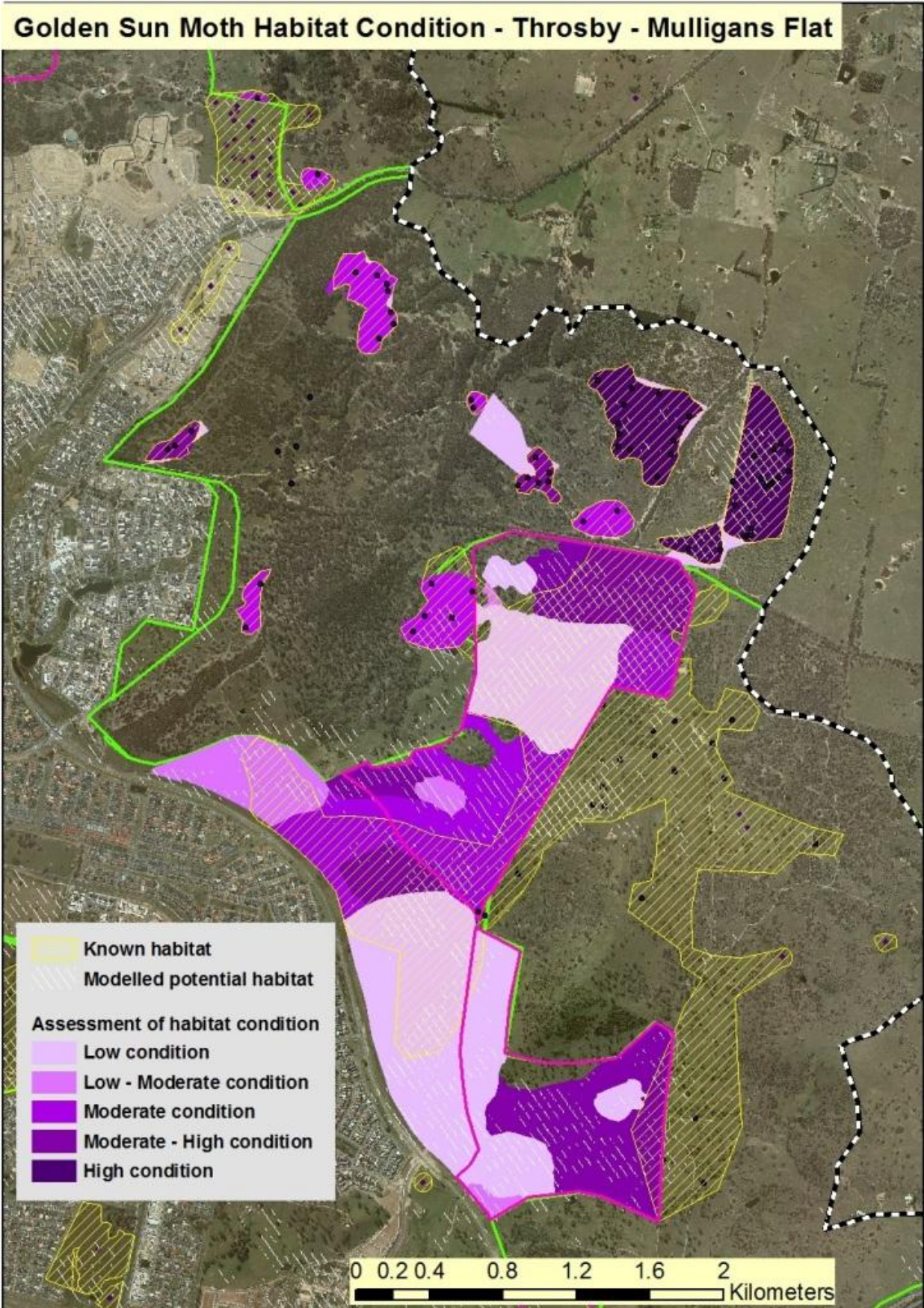
3.2.2 Habitat Requirements

The Golden Sun Moth usually occurs in grasslands dominated by C3 grasses such as wallaby grass (*Rytidosperma* spp.) and spear grass (*Austrostipa* spp.) (ACT Government 2005; Braby and Dunford 2006). Recent studies have also recorded Golden Sun Moth populations in grasslands dominated by Chilean needle grass (*Nasella neesiana*)—a weed of national significance (Braby and Dunford 2006; Downey and Sea 2012).

Braby and Dunford (2006) have recorded female Golden Sun Moths ovipositing on Chilean needle grass. Richter et al. (2013) and W. Sea 2013, pers. comm., have found that larvae collected from the roots of Chilean needle grass were larger than those collected from native grasses. Within the West Macgregor offset site Downey and Sea (2012) also found the highest larvae densities under the Chilean needle grass tussocks (5-8 individuals/m² compared to <2 individuals/m² under the spear grass tussocks (*Austrostipa bigeniculata*)).

Maintaining inter-tussock spaces within Golden Sun Moth habitat is important to assist male Golden Sun Moths locate the sedentary females during the flying season. Biomass management is essential to ensure that the grass species do not develop into a thick sward of rank grass, making it difficult for male Golden Sun Moths to locate females. Maintain tussock height between 10 cm and 20 cm at the time of GSM emergence.

Figure 10. Golden Sun Moth habitat quality classes (from ACT Government 2014c)



3.3 Striped Legless Lizard (*Delma impar*)

Current Distribution: Figure 7 illustrates the distribution of the Striped Legless Lizard habitat and surveyed populations within the Offset Areas.

3.3.1 Description and Life Cycle

Striped Legless Lizards lack forelimbs and have much reduced hind limbs that appear only as small flaps on either side of the vent. Although they resemble snakes, they can be readily distinguished by the presence of external ear openings, a fleshy undivided tongue and a tail, which is longer than the body and can be voluntarily shed (Cogger 2000).

Their colour varies, however typically they are pale grey-brown above and cream below with the head darker than the body. They also have dark brown or black longitudinal stripes along the length of the body, which become diagonal bands on the tail. In some individuals, particularly juveniles, these stripes may be very faint or absent (Cogger 2000).

Male and female Striped Legless Lizards appear very similar, however the adult males may be distinguished by the presence of a small rounded 'spur' under each hind limb flap (Department of the Environment 2015a). They grow to a maximum of 30 cm in length, with a maximum snout-vent length (SVL) of about 12 cm (Department of the Environment 2015a).

The life span of the Striped Legless Lizard is between 10 – 20 years (ACT Government 2014d). It is estimated that the Striped Legless Lizard is sexually mature at two to three years for males and three to four years for females (ACT Government 2014d). Males are thought to be polygynous, mating with more than one female in a single breeding season (Department of the Environment 2015a).

It is estimated that females lay two eggs each year (ACT Government 2014d). These are laid in December and January with an incubation period of 35–60 days (ACT Government 2014d). Cohabitation of wild gravid Striped Legless Lizards (Department of the Environment 2015a) and communal clutches of up to 36 eggs (ACT Government 2014d) have been observed.

Rocks and soil cavities (including artificial arthropod burrows used to capture grassland earless dragons) are used as oviposition sites (ACT Government 2014d).

The diet of the Striped Legless Lizard is comprised of a broad spectrum of invertebrates found in grasslands. They appear however, to show preference for spiders, crickets, caterpillars and cockroaches (ACT Government 2014d). These prey types comprise a greater proportion of the diet compared to their abundance in the field relative to other prey (like ants, beetles, moths and flies) (ACT Government 2014d).

3.3.2 Habitat Requirements

In the ACT, Striped Legless Lizard are found in both primary (i.e. Natural Temperate Grassland) and secondary (derived) grasslands, however they are generally considered to be restricted to secondary grasslands that are within two kilometres of a primary grassland (ACT Government 2014d). They also occur within the transitional zone between grassland and woodland, in open and lightly shaded areas (ACT Government 2014d).

The Striped Legless Lizard requires a defined tussock structure and moderate to high biomass. The preferred habitat structure is tall (30 cm – 80 cm high), dense sward with well-developed ground cover (70-100 percent total ground over) (ACT Government 2014d). The presence of the lizard in areas dominated by exotic tussock species (e.g. *Phalaris*) suggests that it is the structure of the grass sward, rather than the grass species, that is the key determinant of habitat quality (Eco Logical Australia 2012).

Surveys have found highest densities of Striped Legless Lizard in areas with tall, dense grass that has only been lightly grazed (ACT Government 2014d).

The Striped Legless Lizard has a limited home range. Even during the most active period (late spring and early summer) movement is can be restricted to as little as 10 square metres (ACT Government 2014d)

A Striped Legless Lizard survey undertaken in 2012 (Eco Logical Australia 2013) over a ten week period found 76% of recaptured lizards under the same tile, 8.5% of recaptured lizards under an adjacent tile (5m away) and only 8.5% of recaptured lizards greater than 10m from their original capture location. Only one individual was recorded moving more than 20m. That lizard travelled 80m in two weeks in November.

Striped Legless Lizards are however, capable of moving further between local areas as habitats become more or less suitable (ACT Government 2014d). Rauhala *et al.* (1995) noted Striped Legless Lizards present in patches of *Juncus subsecundus* and concluded that wetland and drainage lines, although were not favourable habitat (ACT Government 2014d), may be temporary refuges during dry periods.

Rauhala (1996) also found capture rates (in pitfalls) declined at sites where there was loss of cover from drought and heavy grazing, while simultaneously, capture rates remained high at sites with a higher grass cover. The capture rates increased again when grass cover re-established, suggesting the species is able quickly recolonise sites that are temporarily unsuitable as habitat (Rauhala 1996).

During winter months, Striped Legless Lizards enter a state of torpor, although the exact timing and the torpor sites are mostly unknown (Department of the Environment 2015a). In the ACT, it is though that the lizards refuge in soil cracks or the base of tussocks (ACT Government 2014d).

3.4 Superb Parrot (*Polytelis swainsonii*)

Current Distribution: Figure 4 illustrates the distribution of the Superb Parrot habitat trees and observations within the Mulligans Flat and Gorooyaroo Nature Reserves, including the Offset Areas. They have also been recorded flying over into NSW (to feed) and across Gungahlin, especially Harrison and Forde (J. Bounds 2015, pers. comm. and K. Eyles 2015, pers. comm.).

3.4.1 Description and Life Cycle

The Superb Parrot (*Polytelis swainsonii*) is a slender grass-green parrot, about 400mm in length, with a distinctively long tail. The male has brilliant green plumage with yellow–green underparts. The forehead, throat and cheeks are yellow and there is a scarlet band across the neck. The female is green, with a dull bluish-green face (ACT Government 2004).

It is estimated that the Superb Parrot is sexually mature at two to three years (Low 1980). In the ACT region the Superb Parrot arrives during August to breed, departing the following January.

Females lay between four to six white eggs on a bed of decayed wood in a hollow branch or a hole in the trunk of a large eucalypt (Low 1980). Eggs are incubated for about 20 days, with chicks fledging at about five weeks. The female remains at the nest throughout incubation and until the chicks are well developed (ACT Government 2014a).

During incubation males travel to and from foraging sites where they collect food for the sitting females. Males and females will both forage for chicks and frequently join small foraging flocks, which may also consist of non-breeding birds (Department of the Environment 2015b).

In the ACT, the Superb Parrot appears to have distinctive and separate breeding and foraging areas. Breeding appears to be confined to the Central Molonglo Valley and Throsby Ridge, which includes the Throsby East Offset Area (Figure4). It is thought that between 10 - 20 pairs of Superb Parrot breed at each location, with little feeding activity at either breeding site (ACT Government 2014a).

Surveys of the Superb Parrot across Gungahlin found birds display specific breeding behaviour. An indication of breeding within the Throsby Offset Areas could therefore include:

- copulation
- a reluctance by either sex to leave the vicinity of a tree with a suitable hollow nearby
- female or male observed entering or leaving a hollow
- aggressive interactions between pairs with a potential nest hollow nearby
- the feeding by adult birds of young with very short tails and limited capacity of flight with a possible breeding hollow in the same or nearby tree
- a male 'on station' indicated by the presence of a lone bird perched quietly in a tree occasionally making a soft call with a possible nest hollow in the same or nearby tree (ACT Government 2014a).

The parrots can travel up to 10 km from breeding to foraging areas, following corridors of trees (J. Bounds 2015, pers. comm.). Foraging largely occurs within suburban Belconnen and the Gungahlin suburb of Harrison, where birds largely feed on the seeds or flowers of planted trees and shrubs including elms (*Ulmus* sp.), Red Ironbark (*Eucalyptus sideroxylon*), wattles (*Acacia* sp.) or on grass seeds on suburban sports grounds (ACT Government 2014a).

The species tends to return to traditional nest sites, though use within a particular year will depend on conditions. In the non-breeding season, birds are usually in small flocks of up to 30 with equal proportions of males and females (ACT Government 2014a). The exact relationship between breeding and non-breeding ranges is unclear (Department of the Environment 2015b).

3.4.2 Habitat Requirements

Suitable nesting trees are a critical resource. Across its range the Superb Parrot usually nests in hollow limbs or holes deep in the trunk of large woodland or riparian eucalypts, usually near a permanent water source. Preferred nesting trees are Blakely's Red Gum (*Eucalyptus blakelyi*) or River Red Gum (*E. camaldulensis*). Though in the ACT nesting is within Blakely's Red Gum, Yellow Box (*E. melliodora*) or Scribbly Gum (*E. rossii*) (ACT Government 2014a).

It is not known why Superb Parrots chose to breed on Throsby Ridge. This ridge is dominated by *E. blakelyi*. There is a relative small area of old *E. rossii* and it would appear that breeding events are centred around these trees. Of the 24 possible sites recorded in 2012-13, 71% of these were in *E. rossii* and the presence of these old trees possibly with deep hollows may be an important reason for the location of this nesting site (ACT Government 2014a). This choice of trees is different to that observed elsewhere, including the Molonglo Valley where Blakely's Red Gum is the main tree associated with breeding behaviour. The nesting trees in Molonglo are large and very old and probably again contain deep hollows (ACT Government 2014a).

3.5 Other Conservation Assets

3.5.1 Woodland Birds

Appendix B lists the woodland birds that have been recorded in the Offset Areas and adjacent reserves. This includes a number of woodland-dependent birds and several that prefer more open grassland habitat. Ten of the 11 birds on the ACT threatened list have been recorded (Table 6), as well as a number of others of ACT regional conservation significance. This includes the Scarlet Robin (*Petroica boodang*), for which Mulligans Flat provides important habitat, and the Diamond Firetail (*Stagonopleura guttata*).

Habitat Requirements

Habitat connectivity and diversity are critical for woodland birds. Priority must be given to maintaining or creating connections between woodland patches and providing a range of habitat values. This includes:

- maintaining a diverse understorey of shrubs, herbs and forbs
- maintaining areas of grass that support insects and other invertebrates,
- fallen timber for additional foraging habitat and
- large living and dead trees are for perching, roosting, nesting sites and foraging (ACT Government 2004).

Habitat diversity will also contribute towards reducing the competitive advantage of the native Noisy Miner (*Manorina melanocephala*), which can exclude other birds through aggressive behaviour.

3.5.2 Re-introduced Threatened Species

As part of the extended Sanctuary, the Offset Areas will provide additional habitat for the threatened woodland species that have been re-introduced as part of the [Mulligans Flat-Goorooyarroo Woodland Experiment](#).

4. Habitat Improvement Plan

4.1 Enhancement

4.1.1 Biomass Management

A Biomass Management Plan will be developed to guide the management of the understorey biomass within the Offset Areas.

The Biomass Management Plan will assess each of the options available to manage the biomass within the Offset Area (i.e. grazing, slashing and burning) taking into consideration:

- the habitat management zones for each of the MNES as outlined in the Habitat Improvement Plans (and in Figure 11)
- the management requirements for other natural and cultural (e.g. Mulligans Ploughlands) conservation values
- the recreation requirements within the Offset Areas (section 4.5.1) and
- the fire fuel management requirements (section 5).

The Plan will also describe the biomass management infrastructure and resource requirements. This will include the:

- the placement and specifications of fences, gates and other stock related infrastructure (stock water points and stock yards)
- the placement and specifications of management tracks
- stock requirements (including grazing times and grazing periods as is applicable for each of the MNES). This will include highlighting areas where there are key periods where only light grazing is permitted or when grazing must be excluded.

The Plan will be prepared in consultation with the Mulligans Flat Woodland Sanctuary Management Sub-Committee, Parks and Conservation Service (including the Fire Management Unit) and ACT Government Ecologists.

Conflicting management requirements for MNES

The Habitat Improvement Plans (ACT Government 2014a, b, c, d) describe the conflicting requirements for the MNES within the Offset Areas. A carefully considered approach to managing the Offset Areas is required to ensure that the habitat improvement targets for each MNES are met.

Figure 11 identifies the management zones specific to each of the MNES within the Offset Areas. The recommendations within the Biomass Management Plan will need to consider these zones and the conflicting management requirements.

Figure 11. Matters of National Environmental Significance management zones



4.1.2 Regeneration

- Natural regeneration of indigenous trees and shrubs will be promoted within the Box Gum Woodland areas (Figure 11) to improve connectivity and wildlife movement between the Offset Areas, the adjacent reserves and the surrounding landscape. Regenerating canopy species may also eventually form hollows and provide nesting sites for the Superb Parrot.
- Figure 12 depicts the most effective links, or least cost pathways, for wildlife movement across the Offset Areas. This path was identified using the model that was developed following research by Doer *et al.* (2010) and Doer *et al.* (2014). Doer *et al.* (2010) found that most birds will move through a landscape provided there are patches of habitat that are at least 10ha in size, which are not more than 1.1km apart and which are connected by trees or clumps of trees spaced no more than 100m apart. This research has since been updated and has increased the recommend space between trees or clumps at trees between patches to 150m (Doer *et al.* 2014).
- Within the Offset Areas actions to enhance the natural regeneration of the Box Gum Woodland (e.g. weed control, grazing management and possibly supplementary planting (see below)) will occur in these least cost regional pathways, to ensure they meet the movement requirements determined by Doerr *et al.* (2010) and Doer *et al.* (2014).
- Tree, sapling and shrub regrowth will also be encouraged in areas that are particularly important for woodland bird connectivity such as along the Sullivan's Creek tributaries.
- Tree and shrub cover should however, be maintained at less than 20% within the woodland management zones (ACT Government 2014b). The aim of maintaining tree and shrub cover at this level is to assist in providing habitat opportunities for the Golden Sun Moth, while still providing habitat for woodland birds (M. Mulvaney, 2015 pers. comm. and Evans 2000).
- If required, regenerating trees and shrubs will be fenced to protect them from stock and / or kangaroos.
- Regenerating trees or shrubs must be managed in a way that does not compromise the viability of populations of protected matters that rely on derived native grasslands. This will include managing the Offset Areas to maintain open grassland areas within Golden Sun Moth and Striped Legless Lizard management zones. This will be undertaken by minimising the regeneration of trees and shrubs within these zones. Maintaining an open grassy habitat will also provide suitable habitat for the Bush Stone Curlew.

4.1.3 Revegetation

Canopy and shrub species

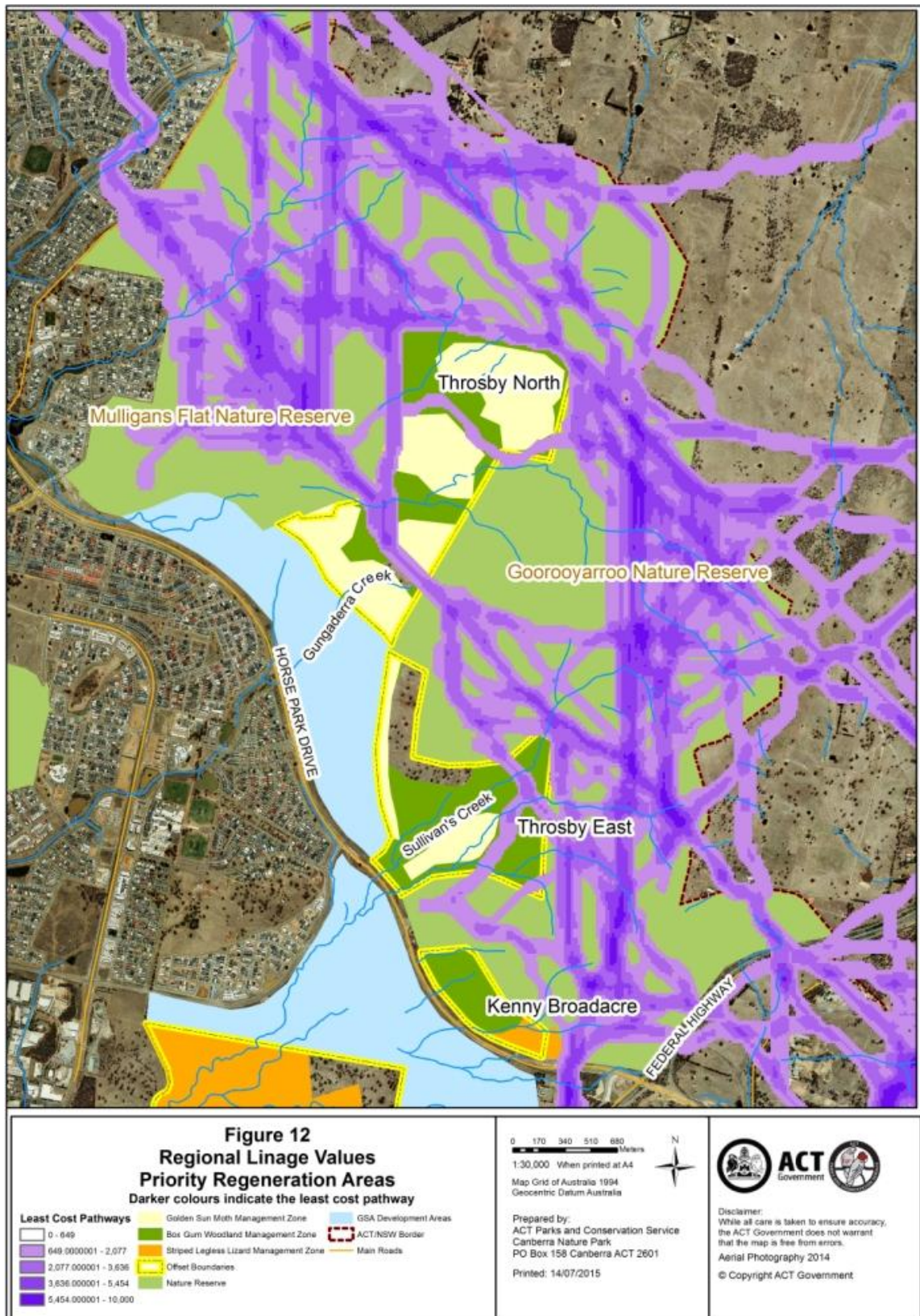
- Revegetation of canopy or shrub species within the Offset Areas will be dependent on the extent and diversity of naturally regenerating plants within the Offset Areas.
- As for the promotion of naturally regenerating trees and shrubs, the location of revegetation works will be guided by the regional linkage model and the (Figure 12).
- Of priority is the revegetation of trees and shrubs along the Sullivan's Creek. Trees and shrubs will be planted in clumps at least every 150m to assist in the movement of the Superb Parrots and other woodland birds.
- Emphasis will be given to planting locally occurring plant species on which the parrots are known to feed.
- The revegetation works will also include some regionally rare species and species with naturally widespread distributions that are more likely to have the genetic capability to cope best with climate change. This will include using plants grown from seed collected from healthy populations and may involve the use of non-local seed or plant material.

- Planting along Sullivan’s Creek will have a dual purpose as it will also contribute towards controlling the active gully erosion. Planting along Sullivan’s Creek can occur only after the completion of the engineer designed erosion control plan (section 4.1.4) and the identification of the location of the stock crossing, as these will influence the position of the fencing, which will also serve to protect the revegetation works.
- The objective will be for tree cover and understorey to reach the benchmark or pre-disturbance condition of the Box Gum Woodland community (tree cover 15-30%, 40 -70% native grass cover, 1-5% shrub cover).
- Planting along the Creek will also need to be cognisant of increased fire risk into suburban areas and will also need to be undertaken outside the Golden Sun Moth and Striped Legless Lizard habitat areas.
- Revegetation may also be undertaken on dam edges to create frog friendly habitat and where appropriate, may serve as wildlife observation locations.

Understorey species

- Revegetation of understorey species will be guided by the results of the vegetation monitoring program and any requirements to increase the diversity and cover of native forbs and grasses to increase the quality of Box Gum Woodland and derived grassland areas.
- All revegetation projects will be subject to a monitoring and maintenance program. Guidelines on undertaking, monitoring and maintaining revegetation or restoration works within the Offset Areas will be developed. These guidelines will be followed by staff and included in the scope of works for contractors undertaking restoration activities within the Offset Areas.
- Where appropriate, consideration should be given to revegetating existing dam edges to create frog friendly habitat. These areas may serve as wildlife observation locations.

Figure 12. Least cost pathways for wildlife movement (connectivity pathways)



4.1.4 Gully Erosion

- An engineer will be engaged to develop an erosion control plan to address the gully erosion along Sullivan's creek within the Throsby East Offset Area. This is likely to include fencing off the eroded gullies from stock and some minor rockwork.
- Any erosion control works will need to consider the revegetation (and associated fencing) requirements along Sullivan's Creek (i.e. to assist in the movement of the Superb Parrots and other woodland birds (section 4.1.3)).
- These works will be monitored to ensure that they remain effective over time.

4.1.5 Sheet Erosion

- Restoration works are required within Throsby East to address the instances of sheet erosion. The area will be revegetated with native grass species that provide suitable habitat for the Golden Sun Moth.
- Seek advice from a suitably qualified revegetation practitioner on how to revegetate areas with compacted soils.
- Guidelines on undertaking, monitoring and maintaining revegetation or restoration works within the Offset Areas will be developed. These guidelines will be followed by staff and included in the scope of works for contractors undertaking restoration activities within the Offset Areas.
- The area may need to be fenced from stock to protect the restoration area.

4.1.6 Placement of Woody Debris

- Woody debris will be salvaged and relocated from the Throsby development site into the Box Gum Woodlands habitat management zones within the Offset Areas (Figure 11). The relocation of woody debris will improve the habitat quality and structural diversity within the Box Gum Woodland community and is an important component of habitat restoration projects.
- The Land Development Agency will be responsible for salvaging and re-distributing the woody debris within the Offset Areas.
- The amount of woody debris within the Offset Areas should not exceed exceeding 25 tonnes per hectare (ACT Government 2014b).
- Heavy machinery will need to be used to re-distribute the woody debris into the Offset Areas. To reduce the risk of damage from the machinery and to ensure the correct placement of the woody debris, the transport and re-location of the woody debris must be undertaken following specific advice from CPR and TAMS.

4.1.7 Eucalyptus Dieback

- Eucalyptus dieback is evident within the Offset Areas, particularly affecting the Blakely's Red Gum (*Eucalyptus blakelyi*), which is an important Superb Parrot nesting species.
- The cause of dieback in the Offset Areas is unclear. Nonetheless, to minimise the impact, stock will be discouraged from camping under trees. This will lead to a reduction in localised compaction and concentration of nutrients, with the aim of improving long-term tree survival.
- In addition,
 - stock water points will be located away from these trees
 - if the soil under affected trees is compacted, soil coring could be trialled to see if this can improve general tree health
 - ecological burns may also be trialled within the Box Gum Woodland community specifically as a treatment for dieback (G. Baines 2013, pers. comm.).

- In the future, scattered Superb Parrot nesting trees may be fenced to prevent soil compaction around the trees and limit disturbance to breeding birds. Anecdotal evidence suggests that the Superb Parrot prefers nesting trees in areas that do not have high grass growth (M. Mulvaney, 2015 pers. comm.). Further investigations are required to determine if these observations are correct, however, in the interim these trees will remain unfenced to prevent high levels of grass growth.

4.2 Assets and Infrastructure

4.2.1 Fencing

Extension of the Mulligans Flat Woodland Sanctuary predator proof fence

The Mulligans Flat Woodland Sanctuary will be extended in 2016-17. This includes extending the existing predator proof fence to incorporate additional land within the Gorooyarroo and Mulligans Flat Nature Reserves, including all the Offset Areas.

The original predator proof fence will be retained until a program to control invasive animal species (i.e. rabbits, hares, foxes and cats) within the extended area is complete. After that time, the fence separating the two sections of the Sanctuary will be removed to create a single expanded Sanctuary.

Internal fencing requirements

- Internal fencing requirements will be described within the Biomass Management Plan (section 4.1.1) and Recreation Plan (section 4.5.1). Additional fencing may also be installed to:
 - protect priority regeneration or revegetation areas
 - assist with erosion control
 - replace or provide for new management and/or pedestrian access gates
 - protect trees with signs of eucalyptus dieback (except for Superb Parrot nesting trees – section 4.1.7)
- Any new fencing will be installed following wildlife friendly specifications.
- The existing fencing layout will be maintained until the completion of the Biomass Management Plan and the Recreation Plan and the subsequent installation of any new fences.

4.2.2 Stock Water and Stockyards

- There are currently nine dams within the Offset Areas (Figure 13). The dams are currently clean and in good condition. Minor earthworks are required to distribute soil that was excavated from within the dams and is currently affecting dam function.
- Additional stock water requirements and the location of stockyards (if required) will be described within the Biomass Management Plan (section 4.1.1).

4.2.3 Tracks and Trails

- The Recreation and Infrastructure Plan (section 4.5.1), Biomass Management Plan (section 4.1.1) and Bushfire Management Strategy (section 5) will guide an expansion or change to the existing network of recreation and management tracks (Figure 13) within the Offset Areas and adjacent reserves.
- To minimise the impacts on the conservation values, existing tracks will be utilised where possible and improved for access and maintenance purposes. Any new track or trails will link with the existing track network and the planned Woodlands Learning Centre.
- Slashed tracks are preferred and a vegetative cover should be maintained on the tracks where possible.
- The development of new tracks may need to be guided by a Construction Environment Management Plan and may trigger a Development Application.

4.2.4 Visitor Infrastructure

- General park signage and signs identifying prohibited activities will be installed at all entrance points into the Offset Areas.
- Minor works will be undertaken to formalise the make-shift car park adjacent to the Kenny Broadacre Offset Area (Figure 13). This will increase the capacity for the public to access the reserves and improve the safety of cars entering and exiting the car park.
- The Mulligans Flat Woodland Sanctuary are currently working towards improving access and visitor signage in the Mulligans Flat Woodlands Sanctuary. The design and placement of new visitor infrastructure must therefore consider the work already undertaken by the Sub-Committee to ensure a consistent approach across the Mulligans Flat – Goorooyarroo reserve complex.

4.2.5 Utilities

Gravity fed sewer lines and sewer access points are located within Throsby North and Throsby East (Figure 13). These are managed by ActewAGL. ACT Government staff must follow the procedures required when planning works within the vicinity of utility infrastructure, including adhering to the Code of Practice between PCS and ActewAGL (ERM 2009)

4.2.6 Site Clean-up

Remove any debris (old fencing wire etc..) from within the reserve. Also required is the removal of asbestos pipes located at a number of the dams.

Figure 13– Infrastructure and Utilities



*Disclaimer: this map provides an overview of the infrastructure and utilities present within the Offset Areas at the time that this Plan was prepared. It does not factor in changes to the infrastructure as a result of implementing this Plan. In addition, the accuracy of the presence and location of the infrastructure and utilities is not guaranteed. The information on this map can assist, but must not be solely used to inform planning or land management decisions. Further investigations to confirm the location of infrastructure and utilities from the appropriate authorities (i.e. dial before you dig) is required.

4.3 Over-abundant or Invasive Plants and Animals

4.3.1 Invasive Plants

- Appendix A includes a list of the exotic plant species recorded in the Offset Areas. The dominant exotic species include grasses such as Serrated tussock (*Nassella tricotoma*), Phalaris (*Phalaris aquatica*), Cocksfoot (*Dactylis glomerata*), Paspalum (*Paspalum dilatatum*) and Yorkshire Fog (*Holcus lanatus*), forbs such as Saffron Thistle (*Carthamus lanatus*), Spear Thistle (*Cirsium vulgare*), Sow Thistle (*Sonchus* sp.) and St John's Wort (*Hypericum perforatum*) and woody weeds including Sweet Briar (*Rosa rubiginosa*) and Blackberry (*Rubus fruticosus* aggregate). African Lovegrass (*Eragrostis curvula*) and Tall Fescue (*Festuca arundinacea*) have also been recorded.
- Serrated tussock and Blackberry are weeds of national significance.
- The weed control program operating within the Mulligans Flat and Gorooyarroo Nature Reserves will be expanded to include the Offset Areas. This program will target weeds that are of high priority for control. This includes invasive tussock grasses such as African Lovegrass, Serrated Tussock and Tall Fescue, woody weeds and exotic herbaceous species such as St John's Wort and Thistles.
- To maintain an open grassland structure regenerating trees and shrubs may need to be removed within identified Golden Sun Moth habitat zones.
- Thinning of thickly regenerating eucalyptus saplings may also need to be considered in Box Gum Woodland areas.
- Weed control within the Superb Parrot habitat area (Figure 4) must occur, unless unavoidable, outside of the September – to mid-January breeding season. Guidelines will be developed by ACT Government Ecologists to assist TAMS staff determine when management actions during the Superb Parrot breeding season may be appropriate.
- Guidelines will also be developed for undertaking weed control in Golden Sun Moth habitat during the flight season (October – January).

4.3.2 Invasive Animals

The program to control foxes, rabbits and hares within the Mulligans Flat and Gorooyarroo Nature Reserves will be expanded to include the Offset Areas. This will be delivered to reduce the impact from these species on native species populations and habitat.

Extension of the Mulligans Flat Woodland Sanctuary

- All foxes, cats and hares were removed from within the Mulligans Flat Woodland Sanctuary. Some rabbits remain and a plan for their eradication is being implemented.
- A program to control and ultimately eradicate foxes, cats, rabbits and hares from the planned expanded sanctuary will commence once the extension to the predator proof fence is complete. Actions to control or eradicate these species within the extended fenced area will follow a strategic approach guided by appropriate experts and informed by the experience gained from similar programs in the original Mulligans Flat Woodland Sanctuary.

Ruderal species

- A commitment with the GSA Plan is to control species that are encouraged by urban development that are not usually a focus of control. The Habitat Improvement Plan for the Superb Parrot (ACT Government 2014a) and Golden Sun Moth (ACT Government 2014b) specifically mentions the control of the Common Myna (*Acridotheres tristis*), Noisy Miner (*Manorina melanocephala*), stray or feral cats and the European Wasp (*Vespa germanica*).
- A strategy will be developed to engage the local community in establishing programs for European Wasp and Common Myna control. These programs will aim to educate and involve local residents in both monitoring (European Wasp and Common Myna) and control activities

(Common Myna only). The strategy will be developed in partnership with TAMS and the LDA and in consultation with the Canberra Indian Myna Action Group (CIMAG). These programs will also be delivered within Offset Areas and adjacent reserves, if required.

- Invasive animal control programs within the Superb Parrot habitat area (Figure 4) must occur, unless unavoidable, outside of the September – to mid-January breeding season. Guidelines will be developed by ACT Government Ecologists to assist TAMS staff determine when management actions during the Superb Parrot breeding season may be appropriate.

4.3.3 Over-abundant Animals

There is potential for the population of Eastern Grey Kangaroos (*Macropus giganteus*) to become over-abundant within the Mulligans Flat and Goorooyaroo Nature Reserves (ACT Government 2010). Kangaroo populations within Canberra Nature Park are managed in accordance with policies outlined in the *ACT Kangaroo Management Plan* (ACT Government 2010).

Kangaroo management within the Mulligans Flat Woodland Sanctuary

Kangaroo numbers were controlled within the Sanctuary in 2010, 2011 and 2012 with the aim of maintaining the desired kangaroo densities for the Mulligans Flat – Goorooyaroo Woodlands Experiment (www.mfgowoodlandexperiment.org.au). The kangaroo densities in five enclosure paddocks are also maintained at a lower level than the rest of the reserve to allow for research.

Following the expansion of the Mulligans Flat Woodland Sanctuary, the current kangaroo management program operating within the Mulligans Flat and Goorooyaroo Nature Reserves will be expanded to include the Offset Areas.

4.3.4 Invasive Pathogens

There are no known pathogen infestations in the Offset Areas.

The incidence of *Phytophthora cinnamomi* in the ACT is thought to be very low and there is no known record of *P. cinnamomi* within the Offset Areas or surrounding landscape. Once present it can however, dramatically modify the structure and composition of native plant communities, resulting in habitat degradation for dependant flora and fauna (Commonwealth of Australia 2014).

To reduce the risk of *P. cinnamomi* entering the Offset Areas, TAMS staff, contractors and volunteers will be educated on the threat imposed by *P. cinnamomi* on the ecological values and how to identify the incidence of *P. cinnamom* within the landscape.

If a *P. cinnamomi* infestation is identified in the local landscape, TAMS staff, contractors and volunteers will be educated on the management objectives and procedures that will need to be implemented to reduced the risk of infecting the Offset Areas. These will follow the guidelines in the *Threat abatement plan for disease in natural ecosystems caused by Phytophthora cinnamomi* (Commonwealth of Australia 2014), and will include:

- vehicles and equipment should be cleaned before entering the Offset Area
- *P. cinnamomi* hygiene protocols will be included in works contracts
- importing raw materials (e.g. gravel, sand, soil and water) will be avoided.

4.4 Managing the Cultural Heritage Values

4.4.1 Aboriginal Heritage

- An aboriginal heritage survey will be undertaken to identify the presence of additional artefacts that have not previously been recorded within the Offset Areas. This will be undertaken in partnership with the traditional land custodians.
- A cultural heritage assessment and associated reporting will also be undertaken in accordance with the guidelines described in the *Cultural Heritage Reporting Policy* (ACT Government 2015b). This document details the cultural assessment and reporting requirements for projects that may impact on places or objects with heritage value. This may include some operational and habitat restoration projects. The ACT Heritage Unit can provide further advice on

assessment requirements.

- In addition, ACT Government *Heritage Act 2004* includes specific provisions that require a person to report the discovery of an Aboriginal place or object to the Heritage Council within five working days. There are also provisions and penalties that apply if a person damages any Aboriginal place or object in the ACT (ACT Government 2015c).

4.4.2 Historic Heritage

Mulligans Flat Ploughlands

The Mulligans Flat Ploughlands and the adjacent enclosure of elms must be conserved and appropriately managed to respect the site's heritage significance and the features intrinsic to that heritage significance.

The Ploughlands are very fragile. The subtle undulations are easily disturbed or destroyed by activities such as:

- ploughing and harrowing
- mowing
- heavy traffic by stock, vehicles and humans
- erosion or siltation
- heavy vegetation cover, which obscures the undulations and impacts the features by root growth (Pearson 2012).

Pearson (2012) provides recommendations for managing the Ploughlands and should be referred to for all management decision. These include:

- stock and kangaroo grazing is an appropriate management tool
- mechanical mowing of ploughlands should be avoided if possible as over time this will flatten the profile of the ridge and furrow features
- if walking tracks are proposed or visitor use is expected to be high within the vicinity of the site, install viewing barriers at the edge of ploughlands or carefully located viewing platforms and boardwalks to avoid disturbing the site
- interpretation signage is recommended, as the Ploughlands are subtle topographic features that may not be obvious to most observers. Interpretation will provide an opportunity to explain the creation of the features and capture the historic imagination of the visitor (Pearson 2012)
- the elms must also be retained.

Inglewood Homestead

Inglewood homestead has no formal heritage status and therefore no statutory protection. An assessment of the heritage values of this site is required. This assessment will include:

- details resulting from research on the historic significance of the site
- a description of the physical features that form part of the complex
- an assessment of the site's heritage significance
- management guidelines to conserve the site's cultural heritage values (D. Chaston 2014, pers. comm.).

Any cultural heritage assessment and associated reports will be undertaken and developed in accordance with the guidelines described in the Cultural Heritage Reporting Policy (ACT Government 2015b).

Any plans will be implemented by TAMS staff.

4.5 Community Engagement

4.5.1 Recreation and Infrastructure Plan

- The current recreation opportunities within the Mulligans Flat and Goorooyarroo Nature Reserves will remain in place.
- A Recreation and Infrastructure Plan will however be developed to assess the demand for community recreation within the Mulligans Flat and Goorooyarroo Nature Reserves and identify how recreation opportunities will be extended to include the Offset Areas. The Recreation Plan will also guide the location and specifications of recreation infrastructure including management tracks and trails, car parks and signs. This may include an upgrade or the maintenance of existing infrastructure.
- The Recreation and Infrastructure Plan will be designed to link in or complement the existing infrastructure in the Mulligans Flat and Goorooyarroo Nature Reserves, the expanding Sanctuary, the Throsby residential area and the planned Woodlands Learning Centre.
- The Plan will be developed in consultation with the Mulligans Flat Woodland Sanctuary Sub-Committee. Consultation will also be undertaken with the Parks and Conservation Service Fire Management Unit when developing the infrastructure component of the Plan.

4.5.2 Interpretation Plan and Interpretation Program

An Interpretation Plan will be developed to guide how TAMS will promote the natural and cultural conservation values within the Offset Areas and engage the community in conservation programs.

The plan will:

- investigate the different interpretation methods available (i.e. traditional (signs) and contemporary (technology based) methods) and assess the effectiveness of these methods to determine how to best disseminate information on the conservation values
- assess the effectiveness of extension programs such as co-ordinating environmental stewardship programs with local schools, designing school curriculum programs on the conservation values with the ACT, field days, ranger guided activities etc
- investigate how to incorporate citizen science into the interpretation program
- outline an interpretation program for each of the Offset Areas based on the recommendations from the investigations described above. The program will include interpretations on both the natural and cultural values within the Offset Areas
- aim to complement existing interpretations with the Mulligans Flat Woodland Sanctuary
- assist to fulfil commitment 30 within the GSA Plan, which aims to establish educational resources for the Throsby residents including that highlight the ecological values and significance of the Mulligans Flat -Goorooyarroo Nature Reserve complex and the management of pest species along the urban edge.

This plan will also be used to guide the interpretation program across the ACT Offsets Network and potentially within other reserves within Canberra Nature Park.

4.5.3 The Friends of Mulligans Flat and Other Community Groups

- The Friends of Mulligans Flat provides a volunteer base that has the capacity to support the management of the expanded Sanctuary and the Offset Areas.
- The Friends can assist with delivery of on-ground rehabilitation works and add value to contracted works.
- TAMS staff will continue to work closely with the Friends of Mulligans Flat to design and implement conservation projects.
- TAMS also supports the continued involvement of other community groups including the

Canberra Ornithologists Group and ACT Waterwatch in managing the conservation values within the Offset Areas and adjoining reserves.

4.5.4 Citizen Science

- TAMS acknowledge and appreciate the long-term contribution that community volunteers have made towards improving our understanding of the local conservation values.
- TAMS will continue to support the involvement of community volunteers in research and monitoring programs within the Mulligans Flat and Gorooyarroo Nature Reserves, including the Mulligans Flat Woodland Sanctuary and encourages these groups to expand their work into the adjoining Offset Areas.
- When delivering the actions within this Plan, where appropriate, additional opportunities for engaging the community will be made available. This could include providing opportunities for community involvement in the research and monitoring programs (e.g. engaging volunteers to assist deliver monitoring and research programs).
- Examples of how the ACT Government will further engage community volunteers in science related programs will also be investigated as part of the interpretation plan (section 4.5.2).

5. Bushfire Hazard Management

The Throsby residential estate does not require an outer asset protection zone within the adjacent Offset Areas (Calibre Consulting 2015a and b). The Offset Areas are however, currently classified as a Strategic Firefighting Advantage Zone (ACT Government 2015d), which requires the bushfire fuel load (biomass) to be managed in accordance with the standards described in the *Strategic Bushfire Management Plan for the ACT* (ACT Government 2014e) (Appendix C).

The areas within the Mulligans Flat and Gorooyarroo Nature Reserves outside of the Offset Areas are classified as Landscape Fire Management Zone. These are not subject to bushfire fuel hazard management requirements under the *Strategic Bushfire Management Plan for the ACT* (ACT Government 2014e).

Commitment 28 with the in GSA Plan requires the development of a bushfire hazard management strategy for the MNES within the Offset Areas. This strategy will be developed concurrently with the the Biomass Management Plan (section 4.1.1) and the Recreation and Infrastructure Plan (section 4.5.1). Combined, these plans will contribute towards ensuring that:

- the biomass within the Offset Areas will be managed to satisfy both the bushfire fuel management and ecological requirements, with a focus on the specific biomass management requirements of each MNES
- the placement and specifications of the infrastructure (fences, tracks and water resources) within the Offset Areas will satisfy the bushfire management, ecological management and recreational requirements of the Offset Areas and adjoining nature reserves
- any bushfire fuel hazard management activities will not be undertaken in a manner that could adversely impact on natural or cultural heritage values within the Offset Areas.

6. Monitoring Plan

6.1 Monitoring MNES

The matters of national environmental significance protected within the Offset Areas will be monitored in accordance to the monitoring program detailed in the Habitat Improvement Plans (ACT Government 2014a, b, c, d). Table 10 provides a summary of the monitoring program. Full details of the monitoring methods and schedule are provided in the relevant Habitat Improvement Plans for each of the MNES (ACT Government 2014a, b, c, d).

Monitoring will be undertaken by ACT Government staff or by suitably qualified consultants. Opportunities will also be provided to community groups and volunteers to participate in the monitoring program, where appropriate.

Table 10. Summary of the MNES Monitoring Program

MNES	Years
Superb Parrot <ul style="list-style-type: none"> The numbers of pairs of Superb Parrots displaying breeding behaviour within the Gungahlin Strategic Assessment area; and The competitive interaction that these birds have with other hollow nesting species. 	Every year from 2015 – 2019, then every three years thereafter.
Striped Legless Lizard population	2015, 2016, 2017 then 2022 and 2023, 2028 and 2029
Golden Sun Moth population	2015, 2016, 2017 then 2020, 2023, 2026
Golden Sun Moth habitat	2015, 2016, 2017 then 2020, 2023, 2026
Box Gum Woodland	2014 (baseline complete), 2017, 2019, 2024, 2029 and 2034

6.2 Monitoring other rare or threatened species

Other conservation values, including species that are considered rare, vulnerable or in decline in the ACT or New South Wales (Tables 6 and 7) will also be monitored as part of established monitoring programs. This includes monitoring programs delivered by community groups and volunteers such as the Friends of Mulligans Flat and the Canberra Ornithologists Group.

6.3 Performance Measures

The following performance measures have been developed to assist in assessing the success of the management program in the Offset Areas.

Box Gum Woodland

1. A measured improvement in the extent of the White Box - Yellow Box - Blakely's Red Gum Grassy Woodland community that meets the EPBC listed criteria. This will be measured by:
 - an increase in the diversity and cover of vegetation structural elements such as trees, shrubs, forbs and grasses, and litter as per the Box Gum Woodland listing advice (Australian Government 2006) and recovery plan (DECCW 2011).
 - a decline in the cover of weed species
 - management of natural recruitment and revegetation to ensure that the flora species assemblage are characteristic of the Box Gum Woodland listing advice (Australian Government 2006)

- an increase in the cover of habitat elements (e.g. woody debris) that is commensurate with the fauna communities that exist within the Box Gum Woodland community
- improved wildlife habitat connectivity
- a decline in the incidence of invasive and over-abundant animals.

Golden Sun Moth

1. Management of Golden Sun Moth habitat to maintain the current extent of Golden Sun Moth populations within the Offset Areas
2. A measured improvement in the quality of Golden Sun Moth habitat.

These will be measured by:

- maintaining or improving the diversity and cover of Golden Sun Moth food species within Golden Sun Moth management areas
- providing habitat structure that is suitable for the Golden Sun Moth within Golden Sun Moth habitat areas
- a decline in the cover of weed species
- controlling the recruitment of trees and shrubs within Golden Sun Moth habitat areas
- a decline in the incidence of invasive and over-abundant animals (including ruderal species).

Superb Parrot

1. Improved management of existing and potential habitat in order to support the recovery of Superb Parrots. This will be measured by:

- protection of known habitat trees
- control of ruderal species
- improved wildlife habitat connectivity
- an increase in the diversity and cover of vegetation structural elements such as trees, shrubs, forbs and grasses, and litter as per the Box Gum Woodland listing advice (Australian Government 2006) and recovery plan (DECCW 2011).

Striped Legless Lizard

1. Management of Striped Legless Lizard habitat to maintain the current Stripe Legless Lizard within the Offset Areas
2. A measured improvement in the quality of Striped Legless Lizard habitat.

These will be measured by:

- providing habitat structure that is suitable for the Striped Legless Lizard within Striped Legless Lizard habitat areas
- a decline in the cover of weed species
- controlling the recruitment of trees and shrubs within Golden Sun Moth habitat areas
- a decline in the incidence of invasive and over-abundant animals (including ruderal species).

These performance measures will be assessed as part of the monitoring program, the results of which, will inform a continual improvement of management and restoration techniques. The results of the monitoring program will be documented in the annual report, which will be published on the web.

The results of the monitoring program will also be disseminated within the ACT Government to

better inform the management of the conservation values within the ACT.

6.4 Additional Monitoring

Operational activities and environmental restoration works such as pest plant and animal control and minor erosion control will be monitored as part of an ongoing program delivered by TAMS. This monitoring will assist identify if corrective actions and/or additional resources are required to undertake operational activities.

A monitoring and maintenance program will be included in the scope of works for environmental restoration activities undertaken by contractors, especially for larger projects.

6.5 Photo Monitoring Points

Photo monitoring points will be established as part of the MNES monitoring program. This includes having photo monitoring points for all vegetation monitoring plots. Photo monitoring will be undertaken following a standardised method outlined in (ACT Government 2014c).

7. Research

Commitment 32 in the GSA Plan requires the ACT Government to deliver on a research program that will provide additional information on how to best manage the MNES protected within the Offset Areas. The first research project is:

- Research aimed at improving our understanding of Superb Parrot breeding and nesting preferences, nest site fidelity, fecundity and whether these are impacted by nearby urban development. The research will also aim to advise on management actions that could improve the suitability of habitat and breeding success.

This project is described within the *Superb Parrot Habitat Improvement Plan* (ACT Government 2014a).

Further research on the other MNES protected within the Offset Areas will also be delivered within the life of the GSA plan. This research has the aim of assisting to improve the long-term conservation of the MNES. There is also scope to deliver a long-term research program as part of the GSA plan.

The research program will be developed in consultation with the Mulligan's Flat Research Committee, with the aim of fostering coordination and collaboration.

8. Management Action Plan

8.1 Offset Planning

Activity	Description	Responsibility	Estimated timeframe for completion	Estimated budget 2015-2016 to 2017-2018	Estimated on-going operational costs (p.a.)
Reserve Operations Plan	An annual reserve operations plan will be developed by operational staff. This plan will to set clear priorities for the management of the conservation values within the Offset Areas and provide detail on how the actions outlined within this Offset Management Plan will be delivered. These plans will be developed following the Urban Reserves Operation Planning System (TAMS, unpublished).	TAMS	Annually	-	-
Approvals required for construction activities (e.g. DA, EIS or CEMP)	<ul style="list-style-type: none"> • Need to discuss proposed construction works with ACTPLA to determine what approvals (if any) are required). • A Construction Environment Management Plan is required for any development or infrastructure (as defined under the <i>Planning and Development Act 2007</i>) within the Nature Reserve when a development application is required. • The Framework for Construction Environment Management Plans: for areas of Gungahlin subject to the Gungahlin Strategic Assessment 2013 (ACT Government 2013b) provides further advice on preparing a CEMP. • The CEMP requires approval by the Plan Implementation Team. This approval can be obtained either before a development application is lodged or as part of the development application process. 	TAMS	As required	-	-

Activity	Description	Responsibility	Estimated timeframe for completion	Estimated budget 2015-2016 to 2017-2018	Estimated on-going operational costs (p.a.)
Biomass Management Plan (for ecological purposes)	<p>Section 4.1.1</p> <p>A Biomass Management Plan will:</p> <ul style="list-style-type: none"> • guide the management of the understorey biomass within the Offset Areas. • assess each of the biomass management options (i.e. grazing, slashing and burning) • describe the biomass management infrastructure and resource requirements. <p>The plan must be prepared in consultation with the Mulligans Flat Sanctuary Management Sub-Committee, PCS and CPR.</p>	TAMS to engage a suitably qualified consultant	2016-2017	\$20,000	-
Utility Notifications	<p>Section 4.2.5</p> <ul style="list-style-type: none"> • Follow the procedures required when planning works within the vicinity of utility infrastructure. • Adhere to the Code of Practice between PCS and ActewAGL (ERM 2009). 	TAMS	As required	-	-

Activity	Description	Responsibility	Estimated timeframe for completion	Estimated budget 2015-2016 to 2017-2018	Estimated on-going operational costs (p.a.)
Cultural Heritage Assessment Reporting and Management requirements	<p>Section 4.4</p> <ul style="list-style-type: none"> Engage the traditional land custodians to undertake aboriginal heritage survey within the Offset Areas Follow the guidelines outlined in the Cultural Heritage Reporting Policy (ACT Government 2015b). This document details the cultural assessment and reporting requirements for projects that may impact on places or objects with indigenous or historic heritage value. Report the discovery of an Aboriginal place or object to the Heritage Council within five working days. Engage a suitably qualified expert to undertake a heritage assessment for the Inglewood Homestead and prepare management guidelines to conserve the site's cultural heritage values. 	TAMS	2016-2017	\$60,000	-
Interpretation Plan	<p>Section 4.5.2</p> <p>Develop an interpretation plan to:</p> <ul style="list-style-type: none"> investigate and assess the effectiveness of traditional and contemporary interpretation methods assess the effectiveness of extension programs outline an interpretation program for the Offset Areas complement existing interpretations with the Mulligans Flat Woodlands Sanctuary <p>The Plan must be prepared in consultation with the Mulligans Flat Woodland Sanctuary Management Sub-Committee and the LDA.</p>	TAMS to engage a suitably qualified consultant	2016-2017	\$20,500	

Activity	Description	Responsibility	Estimated timeframe for completion	Estimated budget 2015-2016 to 2017-2018	Estimated on-going operational costs (p.a.)
Recreation Plan	<p>Section 4.5.1</p> <ul style="list-style-type: none"> Develop a recreation and infrastructure plan for the Offset Areas. This includes linking recreation opportunities within the Mulligans Flat Woodlands Sanctuary, adjacent reserves and the adjacent residential areas. The Plan must be prepared in consultation with the Mulligans Flat Woodland Sanctuary Management Sub-Committee, the PCS Fire Management Unit and the LDA. 	TAMS	2016-2017	\$20,500	-
Bushfire Hazard Management Strategy	<p>Section 5</p> <ul style="list-style-type: none"> Develop a bushfire management plan for the Offset Areas to satisfy both the bushfire fuel management and ecological requirements, with a focus on the specific biomass management requirements of each MNES. The Plan must be prepared in conjunction with the Biomass and the Recreation and Infrastructure plans and in consultation with PCS Fire Management Unit, CPR and the Mulligans Flat Woodlands Sub-Committee. 	TAMS	2016-2017	-	-
Offset Management Plan Review	<p>Section 13.</p> <p>This Plan is scheduled for review in 2018.</p>	TAMS	2018	\$10,500	\$3,200

8.2 Capital Improvements Works

Activity	Description	Responsibility	Estimated timeframe for completion	Estimated budget 2015-2016 to 2017-2018	Estimated on-going operational costs (p.a.)
Predator Proof Fence	<p>Section 4.2.1</p> <ul style="list-style-type: none"> Preliminary planning and installation of a predator proof fence to extend the Mulligans Flat Woodlands Sanctuary. 	TAMS / Mulligans Flat Woodlands Sanctuary Management Sub-Committee	2015-2016 2016-2017	\$150,000 \$768,700	\$107,600
Stock Proof Fencing	<p>Section 4.2.1</p> <ul style="list-style-type: none"> The installation of stock proof fencing will be guided by the Biomass Management Plan, the Recreation Plan and specific ecological management requirements. All new fencing will be installed following wildlife friendly specifications. 	TAMS	Timing to be reviewed following the expansion of the predator proof fence.	\$135,000	\$16,100
Stock Water	<p>Section 4.2.2</p> <ul style="list-style-type: none"> Upgrade existing or install new stock water infrastructure as guided by the biomass management plan. 	TAMS	Timing to be reviewed following the expansion of the predator proof fence.	\$41,000	\$5400
Stockyards	<p>Section 4.2.2</p> <ul style="list-style-type: none"> Funding to upgrade portable stockyards if required 	TAMS	Timing to be reviewed following the expansion of the predator proof fence.	\$5,000	-

Activity	Description	Responsibility	Estimated timeframe for completion	Estimated budget 2015-2016 to 2017-2018	Estimated on-going operational costs (p.a.)
Tracks and Trails	<p>Section 4.2.3</p> <ul style="list-style-type: none"> Expand the existing network of recreation and management tracks and trails as guided by the Recreation Plan (section 4.5.1), Biomass Management Plan (section 4.1.1) and Bushfire Management Strategy (section 5). Seek advice on the planning requirements for this project. An EIS and/or a development application (and CEMP) may be required. 	TAMS	2017-2018	\$162,600	\$16,100
Tractor and Slasher (slashing)	<ul style="list-style-type: none"> Lease a tractor and slasher to assist with track maintenance and biomass management. 	TAMS	On-going	\$125,000	\$43,000
Kenny Broadacre Car Park Upgrade	<p>Section 4.2.4</p> <ul style="list-style-type: none"> Upgrade Kenny Broadacre car park Seek advice and approvals from ACT Roads on design Seek advice on the planning requirements for this project. An EIS and/or a development application (and CEMP) may be required. 	TAMS	2017-2018	\$12,600	\$1000
General Park Signage	<p>Section 4.2.4</p> <ul style="list-style-type: none"> Design, construct and install reserve signage to identify the reserve to the public including prohibited activities. Signs will be installed at all entrance points into the Offset Areas. 	TAMS	2017-2018	\$41,500	\$4300

8.3 Environmental Restoration

Activity	Description	Responsibility	Estimated timeframe for completion	Estimated budget 2015-2016 to 2017-2018	Estimated on-going operational costs (p.a.)
Monitoring of Restoration Works	A monitoring and maintenance program will be included in the scope of works for environmental restoration activities undertaken by contractors.	TAMS	As required	-	-
Revegetation and Protection of Natural Regeneration	<p>Section 4.1.2 and Section 4.1.3</p> <ul style="list-style-type: none"> Natural regeneration of indigenous trees and shrubs will be promoted within the Box Gum Woodland areas. Any revegetation of canopy or shrub species within the Box Gum Woodland will be dependent on the extent and diversity of naturally regenerating plants within the Offset Areas. The management of regenerating trees and shrubs and the location of revegetation works will be guided by the regional linkage model (Figure 12). Revegetation of understorey species will be guided by the results of the vegetation monitoring program and any requirements to increase the diversity and cover of native forbs and grasses to increase the quality of Box Gum Woodland and derived grassland areas. Revegetate dam edges to create frog friendly habitat. Planting will also occur along Sullivan’s Creek to assist control active gully erosion. All revegetation projects will be subject to a monitoring and maintenance program. 	TAMS	2017-2018	\$51,900	\$5,400
Gully Erosion	<p>Section 4.1.4</p> <ul style="list-style-type: none"> Engage a suitably qualified engineer to develop an erosion control plan to address the gully erosion along Sullivan’s Creek. Implement the plan, which will include a monitoring and maintenance program. 	TAMS	2017-2018	\$104,500	\$10,800

Activity	Description	Responsibility	Estimated timeframe for completion	Estimated budget 2015-2016 to 2017-2018	Estimated on-going operational costs (p.a.)
Sheet Erosion	<p>Section 4.1.5</p> <ul style="list-style-type: none"> • Use native grass species to revegetate areas of sheet erosion within Throsby East • All revegetation projects will be subject to a monitoring and maintenance program. 	TAMS	2017-2018	\$52,500	\$5400
Placement of Woody Debris	<p>Section 4.1.6</p> <ul style="list-style-type: none"> • Co-ordinate with the LDA for developers to salvage and relocate woody debris from the impact area to the Offset Areas. • The location of the re-located timber will be guided by a scope of works developed by TAMS. 	LDA and TAMS	2015-2016	Funded by the LDA	-
Site Clean-up	<p>Section 4.2.6</p> <ul style="list-style-type: none"> • Undertake general site cleanup including the removal of old fencing wire, and the safe disposal of asbestos pipe. 	TAMS	2016-2017	\$5,000	-
Eucalyptus Dieback	<p>Section 4.1.7</p> <ul style="list-style-type: none"> • Undertake measures specifically for the purpose of addressing eucalyptus dieback within the Offset Areas (e.g. soil coring to reduce soil compaction) • These actions are to be undertaken following advice from CPR. 	TAMS in consultation with CPR	As advised by CPR	\$10,500	-
Ecological Burning	<p>Section 4.1.1</p> <ul style="list-style-type: none"> • The implementation of an ecological burning program will be guided by the Biomass Management Plan and following advice from CPR. 	TAMS in consultation with CPR	As advised by CPR	\$83,000	\$43,000

Activity	Description	Responsibility	Estimated timeframe for completion	Estimated budget 2015-2016 to 2017-2018	Estimated on-going operational costs (p.a.)
Control Invasive Animals (including ruderal species)	<p>Section 5.3.2</p> <ul style="list-style-type: none"> • Expand the invasive animal control program operating within the Mulligans Flat and Gorooyarroo Nature Reserves to include the Offset Areas. • The program will target foxes, rabbits and hares to reduce the impact from these species on native species populations and habitat. • Extra costs will be associated with invasive animal control (in particular rabbit control) with the expansion of the Mulligans Flat Woodlands Sanctuary. • Any pest animal control within the Superb Parrot habitat area (Figure 4) will occur, where possible, outside of the September – to mid-January breeding season. • Guidelines will be developed by ACT Government Ecologists to assist TAMS staff determine when and how pest control operations can be undertaken during the Superb Parrot breeding season. • Ruderal species also need to be controlled within the Offset Areas. Specifically, this includes: <ul style="list-style-type: none"> – Common Myna (<i>Acridotheres tristis</i>) – Noisy Miner (<i>Manorina melanocephala</i>) – European Wasp (<i>Vespula germanica</i>) – Stray and feral cats • A strategy will be developed in partnership with the LDA to engage the local community in establishing programs for European Wasp and Common Myna control. 	TAMS (and LDA)	Annually	\$268,000 2015-16: \$60,000 2016-17: \$102,600 2017-18: \$105,400	\$86,000

Activity	Description	Responsibility	Estimated timeframe for completion	Estimated budget 2015-2016 to 2017-2018	Estimated on-going operational costs (p.a.)
Manage Overabundant Animals	<p>Section 4.3.3</p> <ul style="list-style-type: none"> Kangaroos will be managed in accordance with the Kangaroo Management Plan (ACT Government 2010). 	TAMS	Annually	\$184,900 2015-16: \$60,000 2016-17: \$61,500 2017-18: \$63,400	\$64,600
Manage Pathogens	<p>Section 4.3.4</p> <ul style="list-style-type: none"> Develop an information hand-out for key staff, contractors and volunteers on the risks from <i>Phytophthora cinnamomi</i> and associated management protocols for working within the Offset Area. These management procedures will be revised immediately if a <i>P. cinnamomi</i> infestation is identified in the vicinity of or within the Offset Area. 	TAMS	2015-2016	-	-
Manage Heritage Sites	<p>Section 4.4</p> <ul style="list-style-type: none"> Manage the cultural heritage values within the Offset Areas according to the relevant management plans and guidelines and as is required under the <i>Heritage Act 2004</i>. 	TAMS	2017-2018	\$20,800	\$5400

8.5 Community Engagement

Activity	Description	Responsibility	Estimated timeframe for completion	Estimated budget 2015-2016 to 2017-2018	Estimated on-going operational costs (p.a.)
ParkCare – Friends of Mulligans Flat Woodlands Sanctuary	Continue to support and engage the Friends of Mulligans Flat and other community groups in the management of the conservation values within the Offset Areas and adjoining reserves.	TAMS	On-going	-	-

Activity	Description	Responsibility	Estimated timeframe for completion	Estimated budget 2015-2016 to 2017-2018	Estimated on-going operational costs (p.a.)
Implement the interpretation program	Deliver stage 1 of interpretation program as described in the interpretation plan (section 4.5.2).	TAMS and LDA	2017-2018	\$52,500	\$10,400
Citizen science	Section 4.5.4 Engage the community in establishing programs for European Wasp and Indian Myna control. These programs will seek to educate and involve local residents in both monitoring (European Wasp and Indian Myna) and control activities (Indian Myna only).	TAMS, CPR and LDA	2017-2018	-	-

8.6 Monitoring and Research

Activity	Description	Responsibility	Estimated timeframe for completion	Estimated budget 2015-2016 to 2017-2018	Estimated on-going operational costs (p.a.)
Monitoring –MNES	Section 6.1 Implement the MNES monitoring program as described within the Habitat Improvement Plans.	TAMS and CPR	On-going until completion of the commitments in the GSA Plan	\$153,800	\$53,800
Monitoring -operations	Section 6.4	TAMS	On-going	-	-
Monitoring – photo points	Section 6.5	TAMS	On-going	-	-
Research	Section 7 A research program will be established to provide additional information on how to best manage the MNES protected within the Offset Areas.	CPR	On-going until completion of the commitments in the GSA Plan	\$307,600	\$107,700

8.7 Management Resources

Activity	Description	Responsibility	Estimated timeframe for completion	Estimated budget 2015-2016 to 2017-2018	Estimated on-going operational costs (p.a.)
Staff costs	Vehicle	TAMS	On-going	\$73,900	\$30,200
	Additional staff resources are required to deliver the actions outlined in this Offset Management Plan. This includes funding to support an Offsets Project Manager, a Ranger and a Field Officer.	TAMS	On-going	\$703,800	\$244,600

Note: items without allocated funds will be delivered using internal staff or funded as part of other actions identified in this plan.

9. Adaptive Management

Adaptive management is a systematic process for continually improving management practices through learning from the outcomes of previous management (Umwelt 2013). A strong feedback loop between monitoring and management will be established. Adaptive management of the Offset Area will comprise of adapting conservation and land management practices in response to:

- ecological data from the monitoring program
- legislative change
- any unforeseen or unplanned management threats
- issues that affect day-to-day operations
- advances in research and land management techniques.

This will enable a flexible approach to the management requirements of the Offset Area, allowing ongoing feedback and refinement of the management strategy.

Adaptive management will be the key mechanism used to:

- address the risks associated with implementing this Plan and
- vary standard operational tasks (as detailed in the Reserve Operational Plan) according to seasonal conditions and natural fluctuations (e.g. in weed or pest density).

This may involve an ongoing evaluation of the management practices undertaken to address issues such as weed infestation, invasive animals, bushfire fuel reduction and revegetation works.

Any changes to the management of the Offset Areas outside the scope of what is to be considered as adaptive management will be presented to the office of the Commonwealth Minister for the Department of the Environment for approval prior to implementation.

10. Corrective Actions

The Habitat Improvement Plans (ACT Government 2014a, b, c, d) describe the corrective actions that will be implemented if, as determined by the monitoring program, there is a measured decline in the:

- population of the Golden Sun Moth or the Striped Legless Lizard
- population or breeding behaviour observations for the Superb Parrot
- quality of the Box Gum Woodland within the Offset Areas.

11. Record Management

TAMS will maintain accurate records substantiating any activities associated with or relevant to the conditions of approval, including measures taken to implement this Plan.

12. Reporting

12.1 Standard Reporting Schedule

The PIT are responsible for submitting a status report to the Commonwealth on the implementation of this Plan over the financial year. The reports are required annually for the first three years and then once every three years until the completion of the GSA Plan or as directed by the PIT.

A reporting template will be provided by the PIT. PCS are required to submit information to be included in the report to the PIT by **31st July** each year.

The reports will include:

- Information on the delivery of the management actions described in this Plan. This includes information on the completion and non-completion of actions, whether the completed actions were successful and if not, then an outline of any proposed changes to the Plan
- A quality/condition reports for each MNES based on the monitoring program for that year
- A report on the outcomes of the research project for that year
- A breakdown of all expenses associated with the delivery of the actions outlined in this Plan.

12.2 Reporting of unanticipated or unapproved incidents

Any construction activities in conservation areas are required to be endorsed by the PIT and will be reported annually. Unanticipated impacts to MNES will be reported at time of incidence, including mitigation/rectification activities. Reporting will include a summary of costs to rectify the incident and a “lessons learned” summary.

13. Management Plan Review

The management actions outlined in this Plan will be reviewed and updated by 2018. Any updates will be in response with the outcomes of the monitoring program (section 6) and in response to advances in our knowledge of the habitat requirements and life cycle of the Golden Sun Moth, Superb Parrot and Striped Legless Lizard and management requirements of the White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland ecological community.

The revised Plan will be developed in consultation with key stakeholders as described in sections 1.6 and 1.7.

It is required that any revisions of this Offset Management Plan are submitted by the PIT to the Commonwealth Minister for the Department of the Environment for approval.

14. References

- ACT Government (2004) *Action Plan No. 27 -ACT Lowland Woodland Conservation Strategy*. Department of Arts, Heritage and Environment, Canberra
- ACT Government (2005) *Action Plan No. 28 – ACT Lowland Native Grassland Conservation Strategy*. ACT Government, Canberra
- ACT Government (2009) *ACT Weeds Strategy 2009 – 2019*. Department of Environment, Climate Change, Energy and Water, Canberra
http://www.environment.act.gov.au/_data/assets/pdf_file/0007/575071/ACT-Weeds-Strategy-2009-2019.pdf
- ACT Government (2010) *Kangaroo Management Plan*. ACT Government Territory and Municipal Services Directorate, Canberra
http://www.tams.act.gov.au/_data/assets/pdf_file/0012/394698/Kangaroo_Management_Plan_complete_for_web.pdf
- ACT Government (2012) *ACT Pest Animal Management Strategy 2012-2022*. Environment and Sustainable Development Directorate, Canberra
http://www.environment.act.gov.au/_data/assets/pdf_file/0008/575117/PAMS_WEB.pdf
- ACT Government (2014a) *Superb Parrot Habitat Improvement Plan. A plan for the management, monitoring and improvement of Superb Parrot habitat in the Throsby-Goorooyaroo Nature Reserve*. ACT Government, Canberra
- ACT Government (2014b) *Box Gum Woodland Condition Improvement Plan*. ACT Government, Canberra
- ACT Government (2014c) *Golden Sun Moth Habitat Improvement Plan*. ACT Government, Canberra
- ACT Government (2014d) *Striped Legless Lizard Habitat Improvement Plan*. ACT Government, Canberra
- ACT Government (2014e) *Strategic Bushfire Management Plan for the ACT*. Version 3. Emergency Services Agency, Canberra <http://esa.act.gov.au/community-information/publications/sbmp/>
- ACT Government (2015a) *Draft Canberra Nature Park Plan of Management 2015-2025*. Environment and Planning Directorate, Canberra
- ACT Government (2015b) *Cultural Heritage Reporting Policy. 1 July 2015*. Environment and Planning Directorate, Canberra
http://www.environment.act.gov.au/_data/assets/pdf_file/0008/733850/Cultural-Heritage-Reporting-Policy-FINAL-endorsed-by-Council-on-9-April-2015-A9766366.pdf
- ACT Government (2015c). *Heritage in the ACT*. Retrieved from:
<http://www.environment.act.gov.au/heritage/heritage-in-the-act#aboriginal>. Accessed 3 May 2015
- ACT Government (2015d) *Regional Fire Management Plan*. Retrieved from:
http://actmapi.act.gov.au/Html5Viewer_1_3_1/Index.html?configBase=http://actmapi.act.gov.au/Geocortex/Essentials/GE3151/REST/sites/SBMP_html/viewers/sbmp_html/virtualdirectory/Resources/Config/Default&runWorkflow=bushfire_agree Accessed 14 July 2015

- Australian Government (2006). *White Box – Yellow Box – Blakely’s Red Gum Grassy Woodlands and Derived Native Grasslands Listing Advice*. Department of the Environment and Heritage, Canberra
- Baker-Gabb (2011) [National Recovery Plan for the Superb Parrot *Polytelis swainsonii*](#). State of Victoria Department of Sustainability and Environment, Melbourne
- Braby, M.F. and Dunford, M. (2006) Field observations on the ecology of the Golden Sun Moth, *Synemon plana* Walker (Lepidoptera: Castniidae). *Australian Entomologist* **33**, 103 – 110.
- Downey, P. and Sea, W. (2012) *Development of Golden Sun Moth translocation methods: Forde development offset. Interim Progress Report*. Canberra University
- Calibre Consulting (2015a) *Throsby Residential Estate, Estate Development Plan. Bushfire Risk Assessment and Management Plan, Sheet 1, 1:25000*. ACT Government Economic Development Directorate, Canberra
- Calibre Consulting (2015b) *Throsby Residential Estate, Estate Development Plan. Bushfire Risk Assessment and Management Plan, Sheet 2, 1:25000*. ACT Government Economic Development Directorate, Canberra
- Canberra Nature Map (2015). *Canberra Nature Map*. Retrieved from: www.canberranaturemap.org. Accessed 4 June 2015
- Cogger, H.G. (2000). *Reptiles and Amphibians of Australia*. 6th Edition. Reed Books, Australia
- Commonwealth of Australia. (2014) Threat abatement plan for disease in natural ecosystems caused by *Phytophthora cinnamomi*. Department of the Environment, Canberra. <http://www.environment.gov.au/biodiversity/threatened/publications/threat-abatement-plan-disease-natural-ecosystems-caused-phytophthora-cinnamomi> .Accessed 28 April 2015
- Cooke, H. (2010) *A Short History of Gungahlin*. Canberra Archaeological Society Inc. Canberra
- Evans, D. (2000). *The influence of exotic shrubs on birds or urban yellow box-Blakely’s red gum (E. melliodora-E. blakelyi) woodland in Canberra*. M.Sc. University of Canberra
- Department of Environment, Climate Change and Water NSW (2010) *National Recovery Plan for White box – Yellow Box – Blakely’s Red gum Grassy Woodland and Derived Native Grassland*. Department of Environment, Climate Change and Water, Sydney
- Department of the Environment (2015a). *Delma impar* in Species Profile and Threats Database, Department of the Environment, Canberra. Available from: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=1649. Accessed 6 March 2015
- Department of the Environment (2015b). *Polytelis swainsonii* in Species Profile and Threats Database, Department of the Environment, Canberra. Available from: <http://www.environment.gov.au/sprat>. Accessed 6 March 2015
- Doerr V.A.J., Doerr E.D., and Davies M.J. (2010). *Does structural connectivity facilitate dispersal of native species in Australia’s fragmented terrestrial landscapes?* Systematic Review No. 44, Collaboration for Environmental Evidence. <http://www.environmentalevidence.org/SR44.html> Accessed 30 May 2014

- Doerr, E.D., Doerr, V.A.J., Davies, M.J., Davey, C. and Allnutt, J. (2014) *Flyways and Byways: Guiding restoration of wildlife corridors*. ACT Government Environment and Sustainable Development Directorate, Canberra
- Dorrough, J. (1995). *Past and present habitat of the Striped Legless Lizard, Delma impar (Pygopodidae), in the Australian Capital Territory*. ACT Parks & Conservation Service, Canberra
- Eco Logical Australia (2011a). *Gunghalin Vegetation Survey and Mapping Report*, Environment and Sustainable Development Directorate, Canberra
- Eco Logical Australia (2011b). *Golden Sun Moth Surveys at One Tree Hill, Kinlyside and Throsby*. Environment and Sustainable Development Directorate and the Territory and Municipal Services Directorate, Canberra
- Eco Logical Australia (2013) *Striped Legless Lizard Surveys 2012: Gungahlin Grassland Nature Reserves - Crace, Mulangari and Gungahlin*. Environment and Sustainable Development Directorate, Canberra
- ERM (2009) *Code of Practice: practical guidelines and standards for co-operation between ACT Parks and Conservation and Lands and ActewAGL*. Environmental Resources Management, Canberra
- Greening Australia Capital Region (2009) *Landscapes under fire: how resilient is revegetation to disturbance by fire?* Greening Australian Capital Region, Canberra
- Hogg, D. (2010) *A strategic approach to the conservation and environmental assessment of Gold Sun Moth sites in the Canberra area. Interim Revised Report prepared on behalf of the Land Development Agency*. David Hogg Pty Ltd
- Jones C.G., Lawton J.H. and Shachak M. 1994. Organisms as ecosystem engineers, *Oikos* 69: 373–386
- Kitchin, M. & Matthews, H. (2012) 2012–13 Ecological guidelines for fuel and fire management operations. Internal Report 2012/01. ACT Government
- Manning, A. D., Wood, J. T., Cunningham, R. B., McIntyre, S., Shorthouse, D. J., Gordon, I. J. and Lindenmayer, D. B. (2011) Integrating research and restoration: the establishment of a long-term woodland experiment in south-eastern Australia. *Australian Zoologist* 35(3): 633-648
- Mulvaney, M. (2012) *The extent and significance of Gungahlin's biodiversity values. Technical Report 24*. Environment and Sustainable Development Directorate, Canberra
- Pearson, M. (2012) *A study of the ploughlands in the ACT*. Canberra
- Rauhala, M.A., D.J. Shorthouse & F. Ingwersen (1995). The Striped Legless Lizard *Delma impar* in the Gunghalin, Majura and Jerrabomberra valleys. Incorporating: A report of the 1994 survey for *Delma impar* and options for the protection and conservation of *Delma impar* in the ACT. *Internal Report 95/2*. ACT: Wildlife Research Unit, ACT Parks and Conservation Service
- Rauhala, M.A. (1996). 1995 survey and monitoring program for the Striped Legless Lizard *Delma impar*. *Internal Report 96/1*. ACT: Wildlife Research Unit, ACT Parks and Conservation Service
- Richter, A., Osborne, W., Hnatiuk, S. and Rowell, A. (2013) Moths in fragments: insights into the biology and ecology of the Australian endangered golden sun moth *Synemon plana*

(Lepidoptera: Castniidae) in natural temperate and exotic grassland remnants. *Journal of Insect Conservation* 17 (6): 1093-1104

Smith, W. J. S. & P. Robertson (1999) *National Recovery Plan for the Striped Legless Lizard (Delma impar): 1999-2003*. NSW National Parks and Wildlife Service. Available at: <http://www.environment.gov.au/resource/national-recovery-plan-striped-legless-lizard-delma-impar-1999-2003> Accessed 10 April 2015

Thackway, R (2012). *Goorooyarroo Nature Reserve site 3, ACT. Ver. 1. VAST-2: Tracking the Transformation of Australia's Vegetated Landscapes*. Australian Centre for Ecological Analysis and Synthesis, University of Queensland, Brisbane. Available at: <http://portal.tern.org.au/goorooyarroo-nature-reserve-site-3-act-ver1-vast-2-tracking-the-transformation-of-australias-vegetated-landscapes-australian-centre-for-ecological-analysis-and-synthesis-university-of-queensland-brisbane> Accessed 20 April 2015

Umwelt (2013a). *Gungahlin Strategic Assessment Biodiversity Plan*. ACT Economic Development Directorate and Umwelt (Australia) Pty Ltd

Umwelt (2013b). *Gungahlin Strategic Assessment: Plan Implementation Team Charter*. ACT Economic and Umwelt (Australia) Pty Ltd

Appendix A: Flora Species List

Common Name	Scientific Name	
Trees		
Blakely's Red Gum	<i>Eucalyptus blakelyi</i>	OA
Apple Box	<i>Eucalyptus bridgesiana</i>	
Broad-leaved Peppermint	<i>Eucalyptus dives</i>	
Bundy	<i>Eucalyptus goniocalyx</i>	
Red Stringybark	<i>Eucalyptus macrorhyncha</i>	OA
Brittle Gum	<i>Eucalyptus mannifera</i>	OA
Yellow Box	<i>Eucalyptus melliodora</i>	OA
Inland Scribbly Gum	<i>Eucalyptus rossii</i>	OA
Candlebark	<i>Eucalyptus rubida</i>	
Black Sally	<i>Eucalyptus stellulata</i>	
Small trees / large shrubs		
Cootamundra Wattle*	<i>Acacia baileyana</i>	
Silver Wattle	<i>Acacia dealbata</i>	
Black Wattle	<i>Acacia decurrens</i>	
Hickory Wattle	<i>Acacia implexa</i>	
Red-leaved Wattle	<i>Acacia rubida</i>	
Drooping She oak	<i>Allocasuarina verticillata</i>	
Cypress pine	<i>Cypress</i> sp.	
Cherry Ballart	<i>Exocarpos cupressiformis</i>	
Apple [#]	<i>Malus</i> sp.	
Pine [#]	<i>Pinus</i> sp.	
Prunus [#]	<i>Prunus</i> sp.	
Shrubs		
Early Wattle	<i>Acacia genistifolia</i>	
Ploughshare Wattle	<i>Acacia gunnii</i>	
Kangaroo Thorn	<i>Acacia paradoxa</i>	
Wattle	<i>Acacia parramattensis</i>	
Wedge-leaved Wattle	<i>Acacia pravissima</i>	
Wattle	<i>Acacia</i> spp.	
Ground-berry	<i>Acrotriche serrulata</i>	
Cranberry Heath	<i>Astroloma humifusum</i>	OA
Bush Pea	<i>Bossiaea buxifolia</i>	OA
Creeping Bossia	<i>Bossiaea prostrata</i>	
Daphne Heath	<i>Brachyloma daphnoides</i>	
Native Blackthorn	<i>Bursaria spinosa</i> subsp.	
Dolly Bush	<i>Cassinia aculeata</i>	
Cassinia	<i>Cassinia longifolia</i>	

Common Name	Scientific Name	
Cassinia	<i>Cassinia quinquefaria</i>	
Hawthorn	<i>Crataegus sp.</i> [#]	
Broom Bitter Pea	<i>Daviesia genistifolia</i>	
Slender Bitter Pea	<i>Daviesia leptophylla</i>	
Bitter Pea	<i>Daviesia mimosoides</i>	
A Parrot-pea	<i>Dillwynia phyllicoides</i>	
Egg and Bacon Peas	<i>Dillwynia sericea</i>	OA
Hop Bushes	<i>Dodonaea viscosa</i>	
Grey Guinea-flower	<i>Hibbertia obtusifolia</i>	OA
Erect Guinea-flower	<i>Hibbertia riparia</i>	
Indigo	<i>Indigofera australis</i>	
Kunzea	<i>Kunzea parvifolia</i>	
Swamp Tea-tree	<i>Leptospermum myrtifolium</i>	
Leucopogon	<i>Leucopogon fletcheri</i>	
Leucopogon	<i>Leucopogon sp.</i>	
Common Beard-heath	<i>Leucopogon virgatus</i>	
Peach Heath	<i>Lissanthe strigosa</i>	OA
Urn heath	<i>Melichrus urceolatus</i>	OA
Curved Rice Flower	<i>Pimelea curviflora var. sericea</i>	OA
Shrubby Rice-flower	<i>Pimelea linifolia</i>	
Rice Flower	<i>Pimelea sp.</i>	
Egg and Bacon Pea	<i>Pultenaea microphylla</i>	
Bush Pea	<i>Pultenaea procumbens</i>	OA
Firethorn	<i>Pyracantha sp.</i> [#]	
Sweet Briar	<i>Rosa rubiginosa</i> [#]	OA
Blackberry	<i>Rubus fruticosus</i> [#]	OA
Grasses		
Common Blown Grass	<i>Agrostis avenacea var. avenacea</i>	
Silvery Hairgrass	<i>Aira caryophyllea</i>	
Hairgrass	<i>Aira sp.</i> [#]	OA
Swamp Wallaby Grass	<i>Amphibromus neesii</i>	
Veined Swamp Wallaby	<i>Amphibromus nervosus</i>	
Brush Speargrass	<i>Aristida behriana</i>	
Purple Wire Grass	<i>Aristida ramosa</i>	OA
Kneed Speargrass	<i>Austrostipa bigeniculata</i>	OA
Foxtail Speargrass	<i>Austrostipa densiflora</i>	OA
Speargrass	<i>Austrostipa scabra</i>	OA
Rough Speargrass	<i>Austrostipa scabra subsp. falcata</i>	
Corkscrew Grass	<i>Austrostipa setacea</i>	
Wild Oats	<i>Avena sp.</i> [#]	OA

Common Name	Scientific Name	
Red-leg Grass	<i>Bothriochloa macra</i>	OA
Quaking Grass	<i>Briza maxima</i> [#]	OA
Shivery Grass	<i>Briza minor</i> [#]	OA
Soft Brome	<i>Bromus hordeaceus</i> [#]	
Silky Brome	<i>Bromus molliformis</i> [#]	
Brome	<i>Bromus sp.</i> [#]	OA
Windmill Grass	<i>Chloris truncata</i>	OA
Barbed-Wire Grass	<i>Cymbopogon refractus</i>	
Rough Dog's Tail	<i>Cynosurus echinatus</i> [#]	OA
Cocksfoot	<i>Dactylis glomerata</i> [#]	
Reed Bent Grass	<i>Deyeuxia quadriseta</i>	
Plume Grass	<i>Dichelachne hirtella</i>	
Short-Haired Plume Grass	<i>Dichelachne micrantha</i>	OA
Plume Grass	<i>Dichelachne rara</i>	
Plume Grass	<i>Dichelachne sp.</i>	
Common Wheat Grass	<i>Elymus scaber</i>	OA
Nineawn Grass	<i>Enneapogon nigricans</i>	
Common Love Grass	<i>Eragrostis brownii</i>	OA
Lovegrass	<i>Eragrostis sp.</i>	
Yorkshire Fog	<i>Holcus lanatus</i> [#]	OA
Barley Grass	<i>Hordeum sp.</i> [#]	OA
Red-anther Wallaby Grass	<i>Joycea pallida</i>	OA
Blowngrass	<i>Lachnagrostis aemula</i>	OA
Perennial Ryegrass	<i>Lolium perenne</i> [#]	OA
Wimmera Ryegrass	<i>Lolium rigidum</i> [#]	
Ryegrass	<i>Lolium sp.</i> [#]	OA
Weeping Grass	<i>Microlaena stipoides</i>	OA
Serrated tussock	<i>Nassella trichotoma</i> [#]	OA
Hairy Panic Grass	<i>Panicum effusum</i>	OA
Phalaris	<i>Phalaris aquatica</i> [#]	OA
Bulbous Bluegrass	<i>Poa bulbosa</i> [#]	
Common Tussock Grass	<i>Poa labillardierei</i>	
Snow Grass	<i>Poa meionectes</i>	
Poa Tussock	<i>Poa sieberiana</i>	OA
Poa	<i>Poa sp.</i>	
Bristle Tail Grass	<i>Psilurus incurvus</i>	
Ringed Wallaby Grass	<i>Rytidosperma caespitosa</i>	
Short Wallaby Grass	<i>Rytidosperma carphoides</i>	OA
Wallaby Grass	<i>Rytidosperma duttoniana</i>	
Bare-backed Wallaby Grass	<i>Rytidosperma laevis</i>	

Common Name	Scientific Name	
Wallaby Grass	<i>Rytidosperma racemosum</i>	OA
Wallaby Grasses	<i>Rytidosperma spp.</i>	OA
Kangaroo Grass	<i>Themeda australis</i>	OA
Five Minute Grass	<i>Tripogon loliiformis</i>	
Squirrel-tail Fescue	<i>Vulpia bromoides</i> [#]	
Rat's Tail Fescue	<i>Vulpia myuros</i> [#]	
Fescue	<i>Vulpia sp.</i> [#]	OA
Herbs and lilies		
Sheep's Burr	<i>Acaena echinata</i>	OA
Bidgee Widgee	<i>Acaena novae-zelandiae</i>	OA
Sheep's Burr	<i>Acaena ovina</i>	OA
Sheep Sorrel	<i>Acetosella vulgaris</i> [#]	OA
Austral Bugloss	<i>Ajuga australis</i>	
Hairy Joyweed	<i>Alternanthera nana</i> [#]	OA
	<i>Alternanthera sp.A</i>	OA
Scarlet Pimpernel	<i>Anagallis arvensis subsp.</i>	
	<i>Anagallis arvensis</i> [#]	OA
Cape Weed	<i>Arctotheca calendula</i> [#]	OA
Vanilla Lily	<i>Arthropodium milleflorum</i>	OA
Small Vanilla Lily	<i>Arthropodium minus</i>	
Common Woodruff	<i>Asperula conferta</i>	OA
Woodruff	<i>Asperula sp.</i>	
Lobe-seed Daisy	<i>Brachyscome dentata</i>	
Leafy Daisy	<i>Brachyscome rigidula</i>	
Golden Lily	<i>Bulbine bulbosa</i>	OA
Bulbine Lily	<i>Bulbine sp.</i>	
Milkmaids	<i>Burchardia umbellata</i>	
Blue Grass Lily	<i>Caesia calliantha</i>	OA
Two-flowered pink	<i>Caladenia dimorpha</i>	
Orchid	<i>Caladenia fuscata</i>	
Musky Caladenia	<i>Caladenia gracilis</i>	
Lemon Beauty Heads	<i>Calocephalus citreus</i>	OA
Shepherds Purse	<i>Capsella bursa-pastoris</i> [#]	
Thistle	<i>Carduus sp.</i> [#]	
Saffron Thistle	<i>Carthamus lanatus</i> [#]	OA
Common Centaury	<i>Centaurium erythraea</i> [#]	OA
Pink Stars	<i>Centaurium sp.</i> [#]	
Common Sneezeweed	<i>Centipeda cunninghamii</i>	OA
	<i>Centrolepis strigosa</i>	OA
Cerastium	<i>Cerastium sp.</i>	OA

Common Name	Scientific Name	
Flat Spurge	<i>Chamaesyce drummondii</i>	OA
Crumbweed	<i>Chenopodium pumilo</i>	OA
Skeleton Weed	<i>Chondrilla juncea</i> [#]	OA
Common Everlasting	<i>Chrysocephalum apiculatum</i>	OA
Clustered Everlasting	<i>Chrysocephalum semipapposum</i>	
Cicendia	<i>Cicendia quadrangularis</i> [#]	
Spear Thistle	<i>Cirsium vulgare</i> [#]	OA
Pink Bindweed	<i>Convolvulus angustissimus</i>	OA
Blushing Bindweed	<i>Convolvulus erubescens</i>	OA
Fleabane	<i>Conyza sp.</i> [#]	OA
Common Cotula / Carrot	<i>Cotula australis</i>	
Billy Buttons	<i>Craspedia glauca</i>	
Billy Buttons	<i>Craspedia variabilis</i>	OA
Austral Stonecrop	<i>Crassula sieberiana</i>	OA
Stonecrop	<i>Crassula sp.</i>	
Sweet Cryptandra	<i>Cryptandra amara var. amara</i>	
Dusky Scurf-pea /	<i>Cullen microcephalum</i>	
Bear's Ear	<i>Cymbonotus lawsonianus</i>	
Bear's Ear	<i>Cymbonotus sp.</i>	OA
Cynoglossum	<i>Cynoglossum sp.</i>	
Sweet Hounds Tongue	<i>Cynoglossum suaveolens</i>	
Austral Carrot	<i>Daucus glochidiatus</i>	
Slender Tick-trefoil	<i>Desmodium varians</i>	OA
Pale Flax Lily	<i>Dianella longifolia</i>	
Black-anther Flax Lily	<i>Dianella revoluta</i>	
Kidney Weed	<i>Dichondra repens</i>	
Chocolate Lily	<i>Dichopogon fimbriatus</i>	OA
Donkey-ears	<i>Diuris semilunulata</i>	
Tiger Orchid	<i>Diuris sulphurea</i>	
Pale Sundew	<i>Drosera peltata</i>	
Patersons Curse	<i>Echium plantagineum</i> [#]	OA
Bugloss	<i>Echium spp.</i>	
Climbing Saltbush	<i>Einadia nutans</i>	OA
Willowherb	<i>Epilobium billardierianum</i>	OA
Long Storksbill	<i>Erodium botrys</i> [#]	OA
Heronbill	<i>Erodium brachycarpum</i> [#]	
Common Crow-foot	<i>Erodium cicutarium</i> [#]	OA
Native Crowfoot	<i>Erodium crinitum</i>	OA
Blue Devil	<i>Eryngium rostratum</i>	OA
Creeping Cudweed	<i>Euchiton gymnocephalus</i>	

Common Name	Scientific Name	
Star Cudweed	<i>Euchiton involucreatus</i>	
Cudweed	<i>Euchiton sp.</i>	OA
Cudweed	<i>Euchiton sphaericus</i>	
Annual trampweed	<i>Facelis retusa</i> #	
Slender Bedstraw	<i>Galium divaricatum</i> #	
Bedstraw	<i>Galium gaudichaudii</i>	OA
Small Bedstraw	<i>Galium murale</i> #	
Cranesbill Geranium	<i>Geranium molle</i>	
Native Geranium	<i>Geranium solanderi</i>	OA
Wax-lip Orchid	<i>Glossodia major</i>	
Twining Glycine	<i>Glycine clandestina</i>	OA
Variable Glycine	<i>Glycine tabacina</i>	OA
Cudweed	<i>Gnaphalium americanum</i>	
Cudweed	<i>Gnaphalium sp.</i>	
Common Raspwort	<i>Gonocarpus tetragynus</i>	OA
Ivy Goodenia	<i>Goodenia hederacea</i>	OA
Scrambled Eggs	<i>Goodenia pinnatifida</i>	OA
Varied Raspwort	<i>Haloragis heterophylla</i>	OA
Button Everlasting	<i>Helichrysum scorpioides</i>	
A Hovea	<i>Hovea heterophylla</i>	
Stinking Pennywort	<i>Hydrocotyle laxiflora</i>	OA
Pennywort	<i>Hydrocotyle peduncularis</i>	OA
Pennywort	<i>Hydrocotyle sp.</i>	
Small St John's Wort	<i>Hypericum gramineum</i>	OA
St John's Wort	<i>Hypericum perforatum</i> #	OA
Smooth Catsear	<i>Hypochaeris glabra</i> #	OA
Flatweed	<i>Hypochaeris radicata</i> #	OA
Golden Weather-grass	<i>Hypoxis hygrometrica</i>	
Swamp Isotome	<i>Isotoma fluviatilis</i>	OA
Prickly Lettuce	<i>Lactuca serriola</i> #	
Scaly Buttons	<i>Leptorhynchus squamatus</i>	OA
Hoary Sunray	<i>Leucochrysum albicans</i>	
Hoary Sunray	<i>Leucochrysum albicans var.</i>	
Toadflax	<i>Linaria arvensis</i> #	
Pelisser's Toadflax	<i>Linaria pelisseriana</i> #	OA
Native Flax	<i>Linum marginale</i>	OA
French Flax	<i>Linum trigynum</i> #	
Narrow Leaved Cudweed	<i>Logfia gallica</i>	
Austral Trefoil	<i>Lotus australis</i>	
Woodrush	<i>Luzula densiflora</i>	OA

Common Name	Scientific Name	
Woodrush	<i>Luzula sp.</i>	
Small Loosestrife	<i>Lythrum hyssopifolia</i>	OA
Mallow	<i>Malva sp.#</i>	
Horehound	<i>Marrubium vulgare#</i>	
Short-fruit Nardoo	<i>Marsilea hirsuta</i>	
Wild Mint	<i>Mentha diemenica</i>	
Yam Daisy	<i>Microseris lanceolata</i>	
	<i>Microtis sp.</i>	OA
Common Onion Orchid	<i>Microtis unifolia</i>	OA
Red-flowered Mallow	<i>Modiola caroliniana#</i>	OA
Erect Chickweed	<i>Moenchia erecta#</i>	OA
Water Blinks	<i>Montia fontana</i>	
Forget-me-not	<i>Myosotis discolor#</i>	
Myriophyllum	<i>Myriophyllum sp.</i>	
Scotch Thistle	<i>Onopordum acanthium#</i>	OA
Hairy Stinkweed	<i>Opercularia hispida</i>	
Austral Adder's Tongue	<i>Ophioglossum lusitanicum subsp.</i>	
Native Carraway	<i>Oreomyrrhis eriopoda</i>	
Broomrape	<i>Orobanche minor#</i>	
Grassland Wood Sorrel	<i>Oxalis perennans</i>	OA
Red Bartsia	<i>Parentucellia latifolia#</i>	OA
Chilean Whitlow	<i>Paronychia brasiliana#</i>	OA
Slender Knotweed	<i>Persicaria decipiens</i>	
Persicaria	<i>Persicaria prostrata.</i>	OA
Proliferous Pink	<i>Petrorhagia nanteuili#</i>	OA
Buck's Horn Plantain	<i>Plantago coronopus#</i>	
Narrow Plantain	<i>Plantago gaudichaudii</i>	OA
Ribwort Plantain	<i>Plantago lanceolata#</i>	OA
Plantain	<i>Plantago sp.</i>	
Variable Plantain	<i>Plantago varia</i>	OA
Dwarf Milkwort	<i>Polygala japonica</i>	
Wireweed	<i>Polygonum aviculare#</i>	
Pomaderris	<i>Pomaderris angustifolia</i>	
Poranthera	<i>Poranthera microphylla</i>	
Whiteroot	<i>Pratia purpurascens</i>	
Jersey Cudweed	<i>Pseudognaphalium luteoalbum</i>	OA
Australian Buttercup	<i>Ranunculus lappaceus</i>	OA
Buttercup	<i>Ranunculus sessiliflorus var.</i>	
Wild Radish, Jointed	<i>Raphanus raphanistrum#</i>	
Weld	<i>Reseda luteola#</i>	

Common Name	Scientific Name	
	<i>Riccia limbata</i>	
Swamp Dock	<i>Rumex brownii</i>	OA
Curled Dock	<i>Rumex crispus</i> [#]	OA
Dock	<i>Rumex sp.</i>	
Wild Sage	<i>Salvia verbenaca</i> [#]	
Hill Fireweed	<i>Senecio hispidulus</i>	
Cotton Fireweed	<i>Senecio quadridentatus</i>	OA
Senecio	<i>Senecio sp.</i>	
Scourweed	<i>Sisyrinchium sp a</i>	OA
Blackberry Nightshade	<i>Solanum nigrum</i> [#]	
Smooth Solenogyne	<i>Solenogyne dominii</i>	OA
Hairy Solenogyne	<i>Solenogyne gunnii</i>	
	<i>Spergularia rubra</i>	OA
Creamy Candles	<i>Stackhousia monogyna</i>	
Prickly Starwort	<i>Stellaria pungens</i>	
Spoon Cudweed	<i>Stuartina muelleri</i>	
Grass Trigger Plant	<i>Stylidium graminifolium</i>	
Nodding Blue Lily	<i>Stypantra glauca</i>	
	<i>Syzygium Sp A</i>	OA
Dandelion	<i>Taraxacum officinale</i> [#]	
Dotted Sun Orchid	<i>Thelymitra ixioides</i>	
Slender Sun Orchid	<i>Thelymitra pauciflora</i>	
Sun Orchid	<i>Thelymitra sp.</i>	
Twining Fringe-lily	<i>Thysanotus patersonii</i>	
Fringed Lily	<i>Thysanotus tuberosus</i>	
Yellow Hawkweed	<i>Tolpis umbellata</i> [#]	OA
Yellow Rush Lily	<i>Tricoryne elatior</i>	OA
Narrow-leaved Clover	<i>Trifolium angustifolium</i> [#]	
Haresfoot Clover	<i>Trifolium arvense</i> [#]	
Hop Clover	<i>Trifolium campestre</i> [#]	
Yellow Suckling Clover	<i>Trifolium dubium</i> [#]	
Clover	<i>Trifolium glomeratum</i> [#]	
Clover	<i>Trifolium spp.</i> [#]	OA
Knotted Clover	<i>Trifolium striatum</i> [#]	
Subterranean Clover	<i>Trifolium subterraneum</i> [#]	
Annual Daisy	<i>Triptilodiscus pygmaeus</i>	OA
Common Sunray	<i>Triptilodiscus pygmaeus</i>	
Spur Velleia	<i>Velleia paradoxa</i>	
Great Mullein	<i>Verbascum thapsus</i> [#]	
Twiggy Mullein	<i>Verbascum virgatum</i> [#]	

Common Name	Scientific Name	
Hairy Speedwell	<i>Veronica calycina</i>	
Speedwell	<i>Veronica gracilis</i>	
Wandering Speedwell	<i>Veronica peregrina</i> [#]	
Purple Violet	<i>Viola betonicifolia</i>	
	<i>Vittadinia cuneata</i>	OA
Fuzzy New Holland Daisy	<i>Vittadinia cuneata var. cuneata</i>	
New Holland Daisy	<i>Vittadinia gracilis</i>	
Narrow-leafed New	<i>Vittadinia muelleri</i>	OA
Tufted Bluebell	<i>Wahlenbergia communis</i>	OA
Graceful Bluebell	<i>Wahlenbergia gracilis</i>	OA
Granite Bluebell	<i>Wahlenbergia graniticola</i>	
Yellowish Bluebell	<i>Wahlenbergia luteola</i>	
Tadgell's Bluebell	<i>Wahlenbergia multicaulis</i>	
Bluebells	<i>Wahlenbergia spp.</i>	
Tall Bluebell	<i>Wahlenbergia stricta</i>	OA
Early Nancy	<i>Wurmbea dioica</i>	OA
Sticky Everlasting	<i>Xerochrysum viscosum</i>	
Rushes and sedges		
Small Sedge	<i>Carex appressa</i>	OA
Sedge	<i>Carex bichenoviana</i>	
Short-stem Sedge	<i>Carex breviculmis</i>	
Knob Sedge	<i>Carex inversa</i>	OA
Sedge	<i>Carex sp.</i>	
Rush	<i>Juncus australis</i>	OA
Toad Rush	<i>Juncus bufonius</i>	
Rush	<i>Juncus capitatus</i>	OA
Pinrush	<i>Juncus filicaulis</i>	
Rush	<i>Juncus flavidus</i>	
Rush	<i>Juncus homalocaulis</i>	
Tall Juncus	<i>Juncus large</i>	
Rushes	<i>Juncus sp.</i>	OA
Rush	<i>Juncus sp</i> [#]	
Finger Rush	<i>Juncus subsecundus</i>	OA
Wattle Mat-rush	<i>Lomandra filiformis</i>	OA
Wattle Mat-rush	<i>Lomandra filiformis subsp.</i>	OA
Spiny-headed Mat-rush /	<i>Lomandra longifolia</i>	OA
Many-flowered Mat-rush	<i>Lomandra multiflora</i>	OA
Umbrella Sedge	<i>Cyperus eragrostis</i>	
Common Spike-rush	<i>Eleocharis acuta</i>	
Variable Sword Sedge	<i>Lepidosperma laterale</i>	

Common Name	Scientific Name	
Spike-rush	<i>Eleocharis sp.</i>	
Common Bog Sedge	<i>Schoenus apogon</i>	OA
Rush	<i>Scirpus sp.</i>	
Ferns		
Rock Fern	<i>Cheilanthes austrotenuifolia</i>	OA
Rock Fern	<i>Cheilanthes sieberi</i>	OA
Narrow Rock Fern	<i>Cheilanthes sieberi subsp. sieberi</i>	
Aquatic species		
Water Blinks	<i>Montia fontana</i>	
Myriophyllum	<i>Myriophyllum sp.</i>	OA
Persicaria	<i>Persicaria sp.</i>	
Pondweed	<i>Potamogeton sp.</i>	
Floating Pondweed	<i>Potamogeton tricarinatus</i>	
Climbers and scramblers		
False Sarsaparilla	<i>Hardenbergia violacea</i>	
Epiphytes		
Mistletoe	<i>Amyema sp</i>	OA

exotic species

OA – recorded in Offset Areas

Appendix B: Fauna Species List

Common Name	Scientific Name
Canberra Ornithologist Bird Species List	
Australasian Darter	<i>Anhinga novaehollandiae</i>
Australasian Grebe	<i>Tachybaptus novaehollandiae</i>
Australasian Pipit	<i>Anthus novaeseelandiae</i>
Australasian Shoveler	<i>Anas rhynchotis</i>
Australian Hobby	<i>Falco longipennis</i>
Australian King Parrot	<i>Alisterus scapularis</i>
Australian Magpie	<i>Gymnorhina tibicen</i>
Australian Owlet-nightjar	<i>Aegotheles cristatus</i>
Australian Pelican	<i>Pelecanus conspicillatus</i>
Australian Raven	<i>Corvus coronoides</i>
Australian Reed-Warbler	<i>Acrocephalus australis</i>
Australian Shelduck	<i>Tadorna tadornoides</i>
Australian Spotted Crake	<i>Porzana fluminea</i>
Australian White Ibis	<i>Threskiornis moluccus</i>
Australian Wood Duck	<i>Chenonetta jubata</i>
Banded Lapwing	<i>Vanellus tricolor</i>
Black Honeyeater	<i>Sugomel niger</i>
Black Swan	<i>Cygnus atratus</i>
Black-faced Cuckoo-shrike	<i>Coracina novaehollandiae</i>
Black-faced Monarch	<i>Monarcha melanopsis</i>
Black-fronted Dotterel	<i>Elseyornis melanops</i>
Black-shouldered Kite	<i>Elanus axillaris</i>
Brown Falcon	<i>Falco berigora</i>
Brown Goshawk	<i>Accipiter fasciatus</i>
Brown Quail	<i>Coturnix ypsilophora</i>
Brown Thornbill	<i>Acanthiza pusilla</i>
Brown Treecreeper	<i>Climacteris picumnus</i>
Brown-headed Honeyeater	<i>Melithreptus brevirostris</i>
Brush Cuckoo	<i>Cacomantis variolosus</i>
Buff-rumped Thornbill	<i>Acanthiza reguloides</i>
Channel-billed Cuckoo	<i>Scythrops novaehollandiae</i>
Chestnut Teal	<i>Anas castanea</i>
Collared Sparrowhawk	<i>Accipiter cirrocephalus</i>
Common Blackbird #	<i>Turdus merula</i>

Common Name	Scientific Name
Common Bronzewing	<i>Phaps chalcoptera</i>
Common Myna #	<i>Sturnus tristis</i>
Common Starling #	<i>Sturnus vulgaris</i>
Crested Pigeon	<i>Ocyphaps lophotes</i>
Crested Shrike-tit	<i>Falcunculus frontatus</i>
Crimson Rosella	<i>Platycercus elegans</i>
Diamond Firetail	<i>Stagonopleura guttata</i>
Dollarbird	<i>Eurystomus orientalis</i>
Double-barred Finch	<i>Taeniopygia bichenovii</i>
Dusky Moorhen	<i>Gallinula tenebrosa</i>
Dusky Woodswallow	<i>Artamus cyanopterus</i>
Eastern Great Egret	<i>Ardea modesta</i>
Eastern Rosella	<i>Platycercus eximius</i>
Eastern Spinebill	<i>Acanthorhynchus tenuirostris</i>
Eastern Yellow Robin	<i>Eopsaltria australis</i>
Eurasian Coot	<i>Fulica atra</i>
Eurasian Skylark	<i>Alauda arvensis</i>
Eurasian Skylark#	<i>Alauda arvensis</i>
European Goldfinch #	<i>Carduelis carduelis</i>
Fairy Martin	<i>Petrochelidon ariel</i>
Fan-tailed Cuckoo	<i>Cacomantis flabelliformis</i>
Flame Robin	<i>Petroica phoenicea</i>
Fork-tailed Swift	<i>Apus pacificus</i>
Freckled Duck	<i>Stictonetta naevosa</i>
Fuscous Honeyeater	<i>Lichenostomus fuscus</i>
Galah	<i>Eolophus roseicapilla</i>
Gang-gang Cockatoo	<i>Callocephalon fimbriatum</i>
Glossy Ibis	<i>Plegadis falcinellus</i>
Golden Whistler	<i>Pachycephala pectoralis</i>
Golden-headed Cisticola	<i>Cisticola exilis</i>
Great Cormorant	<i>Phalacrocorax carbo</i>
Grey Butcherbird	<i>Cracticus torquatus</i>
Grey Currawong	<i>Strepera versicolor</i>
Grey Fantail	<i>Rhipidura albiscapa</i>
Grey Shrike-thrush	<i>Colluricincla harmonica</i>
Grey Teal	<i>Anas gracilis</i>

Common Name	Scientific Name
Hardhead	<i>Aythya australis</i>
Hoary-headed Grebe	<i>Poliiocephalus poliocephalus</i>
Hooded Robin	<i>Melanodryas cucullata</i>
Horsfield's Bronze-Cuckoo	<i>Chalcites basalis</i>
House Sparrow #	<i>Passer domesticus</i>
Jacky Winter	<i>Microeca fascinans</i>
Latham's Snipe	<i>Gallinago hardwickii</i>
Laughing Kookaburra	<i>Dacelo novaeguineae</i>
Leaden Flycatcher	<i>Myiagra rubecula</i>
Little Black Cormorant	<i>Phalacrocorax sulcirostris</i>
Little Corella	<i>Cacatua saguinea</i>
Little Eagle	<i>Hieraaetus morphnoides</i>
Little Friarbird	<i>Philemon citreogularis</i>
Little Grassbird	<i>Megalurua gramineus</i>
Little Lorikeet	<i>Glossopsitta pusilla</i>
Little Pied Cormorant	<i>Phalacrocorax melanoleucos</i>
Little Raven	<i>Corvus mellori</i>
Little Wattlebird	<i>Anthochaera chrysoptera</i>
Magpie-lark	<i>Grallina cyanoleuca</i>
Marsh Sandpiper	<i>Tringa stagnatilis</i>
Masked Lapwing	<i>Vanellus miles</i>
Masked Woodswallow	<i>Artamus personatus</i>
Mistletoebird	<i>Dicaeum hirundinaceum</i>
Musk Duck	<i>Biziura lobata</i>
Nankeen Kestrel	<i>Falco cenchroides</i>
Nankeen Night-Heron	<i>Nycticorax caledonicus</i>
New Holland Honeyeater	<i>Phylidonyris novaehollandiae</i>
Noisy Friarbird	<i>Philemon corniculatus</i>
Noisy Miner	<i>Manorina melanocephala</i>
Olive-backed Oriole	<i>Oriolus sagittatus</i>
Pacific Black Duck	<i>Anas superciliosa</i>
Painted Button-quail	<i>Turnix varius</i>
Painted Honeyeater	<i>Grantiella picta</i>
Pallid Cuckoo	<i>Cacomantis pallidus</i>
Peaceful Dove	<i>Geopelia striata</i>
Peregrine Falcon	<i>Falco peregrinus</i>

Common Name	Scientific Name
Pied Butcherbird	<i>Cracticus nigrogularis</i>
Pied Currawong	<i>Strepera graculina</i>
Pink-eared Duck	<i>Malacorhynchus membranaceus</i>
Purple Swampphen	<i>Porphyrio porphyrio</i>
Rainbow Bee-eater	<i>Merops ornatus</i>
Red Wattlebird	<i>Anthochaera carunculata</i>
Red-browed Finch	<i>Neochmia temporalis</i>
Red-capped Robin	<i>Petroica goodenovii</i>
Red-kneed Dotterel	<i>Erythronyctes alba</i>
Red-rumped Parrot	<i>Psephotus haematonotus</i>
Regent Honeyeater	<i>Xanthomyza phrygia</i>
Restless Flycatcher	<i>Myiagra inquieta</i>
Rock Dove [#]	<i>Columba livia</i>
Rose Robin	<i>Petroica rosea</i>
Rufous Fantail	<i>Rhipidura rufifrons</i>
Rufous Songlark	<i>Cincloramphus mathewsi</i>
Rufous Whistler	<i>Pachycephala rufiventris</i>
Sacred Kingfisher	<i>Todiramphus sanctus</i>
Scarlet Robin	<i>Petroica boodang</i>
Sharp-tailed Sandpiper	<i>Calidris acuminata</i>
Shining Bronze-Cuckoo	<i>Chrysococcyx lucidus</i>
Silvereye	<i>Zosterops lateralis</i>
Southern Boobook	<i>Ninox novaeseelandiae</i>
Southern Whiteface	<i>Aphelocephala leucopsis</i>
Speckled Warbler	<i>Chthonicola sagittata</i>
Spotted Harrier	<i>Circus assimilis</i>
Spotted Pardalote	<i>Pardalotus punctatus</i>
Spotted Turtle-dove [#]	<i>Spilopelia chinensis</i>
Straw-necked Ibis	<i>Threskiornis spinicollis</i>
Striated Pardalote	<i>Pardalotus striatus</i>
Striated Thornbill	<i>Acanthiza lineata</i>
Stubble Quail	<i>Coturnix pectoralis</i>
Sulphur-crested Cockatoo	<i>Cacatua galerita</i>
Superb Fairy-wren	<i>Malurus cyaneus</i>
Superb Parrot	<i>Polytelis swainsonii</i>
Swift Parrot	<i>Lathamus discolor</i>

Common Name	Scientific Name
Tawny Frogmouth	<i>Podargus strigoides</i>
Tree Martin	<i>Petrochelidon nigricans</i>
Turquoise Parrot	<i>Neophema pulchella</i>
Varied Sittella	<i>Daphoenositta chrysoptera</i>
Wedge-tailed Eagle	<i>Aquila audax</i>
Weebill	<i>Smicrornis brevirostris</i>
Welcome Swallow	<i>Hirundo neoxena</i>
Western Gerygone	<i>Gerygone fusca</i>
Whistling Kite	<i>Haliastur sphenurus</i>
White-bellied Cuckoo-shrike	<i>Coracina papuensis</i>
White-bellied Sea-eagle	<i>Haliaeetus leucogaster</i>
White-browed Scrubwren	<i>Sericornis frontalis</i>
White-browed Woodswallow	<i>Artamus superciliosus</i>
White-eared Honeyeater	<i>Lichenostomus leucotis</i>
White-faced Heron	<i>Egretta novaehollandiae</i>
White-fronted Chat	<i>Epthianura albifrons</i>
White-naped Honeyeater	<i>Melithreptus lunatus</i>
White-necked Heron	<i>Ardea pacifica</i>
White-plumed Honeyeater	<i>Lichenostomus penicillatus</i>
White-throated Gerygone	<i>Gerygone olivacea</i>
White-throated Needle-tail	<i>Hirundapus caudacutus</i>
White-throated Nightjar	<i>Eurostopodus mystacalis</i>
White-throated Treecreeper	<i>Cormobates eucophaeus</i>
White-winged Chough	<i>Corcorax melanorhamphos</i>
White-winged Triller	<i>Lalage tricolor</i>
Willie Wagtail	<i>Rhipidura leucophrys</i>
Yellow Thornbill	<i>Acanthiza nana</i>
Yellow-billed Spoonbill	<i>Platalea flavipes</i>
Yellow-faced Honeyeater	<i>Lichenostomus chrysops</i>
Yellow-rumped Thornbill	<i>Acanthiza chrysorrhoa</i>
Yellow-tailed Black Cockatoo	<i>Calyptorhynchus funereus</i>
Invertebrates	
Golden Sun Moth	<i>Synemon plana</i>
Perunga Grasshopper	<i>Perunga ochracea</i>
Reptiles	
Bearded Dragon	<i>Pogona barbatus</i>

Common Name	Scientific Name
Black-headed Snake	<i>Suta spectabilis</i>
Blind Snake	<i>Ramphotyphlops nigrescens</i>
Boulenger's Skink	<i>Morethia boulengeri</i>
Common Blue Tongue	<i>Tiliqua scincoides</i>
Cunningham's Skink	<i>Egernia cunninghami</i>
Delicate Skink	<i>Lampropholis. delicata</i>
Eastern Brown Snake	<i>Pseudonaja textilis</i>
Eastern Long-necked Tortoise	<i>Chelodina longicollis</i>
Garden Skink	<i>Lampropholis guichenoti</i>
Olive Legless Lizard	<i>Delma inornata</i>
Shingleback	<i>Trachydosaurus rugosus</i>
Spotted-back Skink	<i>Ctenotus uber</i>
Stone Gecko	<i>Diplodactylus vittatus</i>
Striped Legless Lizard	<i>Delma impar</i>
Three-toed Skink	<i>Hemiergis decresiensis</i>
Mammals	
Black Rat [#]	<i>Rattus rattus</i>
Brown Hare [#]	<i>Lepus capensis</i>
Cat [#]	<i>Felis catus</i>
Chocolate wattled bat	<i>Chalinolobus morio</i>
Common Brushtail Possum	<i>Trichosurus vulpecula</i>
Common Dunnart	<i>Sminthopsis murina</i>
Eastern Grey Kangaroo	<i>Macropus giganteus</i>
Fox [#]	<i>Vulpes vulpes</i>
Gould's Wattled Bat	<i>Chalinolobus gouldii</i>
House Mouse [#]	<i>Mus musculus</i>
Large Forest Bat	<i>Vespadelus darlingtoni</i>
Lesser Long-eared Bat	<i>Nyctophilus geoffroyi</i>
Rabbit [#]	<i>Oryctolagus cuniculus</i>
Red-necked wallaby	<i>Macropus rufogriseus</i>
Short-beaked echidna	<i>Tachyglossus aculeatus</i>
Sugar Glider	<i>Petaurus breviceps</i>
Swamp Wallaby	<i>Wallabia bicolor</i>
White-striped Freetail-bat	<i>Nytonomus australis</i>
Amphibians	
Common Eastern Froglet	<i>Crinia signifera</i>

Common Name	Scientific Name
Eastern Banjo Frog	<i>Limnodynastes dumerilii</i>
Peron's Tree Frog	<i>Litoria peronii</i>
Plains Froglet	<i>Limnodynastes tasmaniensis</i>
Smooth Toadlet	<i>Uperoleia laevigata</i>
Spotted Burrowing Frog	<i>Neobatrachus sudelli</i>
Spotted Grass Frog	<i>Limnodynastes tasmaniensis</i>
Verreaux's Tree Frog	<i>Litoria verreauxii</i>

exotic species

Appendix C: Fuel Management Standards for the Strategic Firefighting

Advantage Zone

Strategic Firefighting Advantage Zone	Treatment standards	
Default standards to be applied over at least 70% of the zones as mapped. Where default standards cannot be achieved, the responsible land manager may identify alternative treatments to meet the overall objectives for the zone. Any significant variation on the default standards shall be approved by the Emergency Services Agency.	Vegetation type	Fuel management standards
	Forest and shrubland	Overall fuel hazard \leq high
	Grass and open woodland	Grassland fuel hazard \leq 50 when grassland curing \geq 70%
	Identifies arterial roads, rural roads and easements	Grassland fuel hazard \leq 35 when grassland curing \geq 70%.

Source: ACT Government 2014

The current fuel management standard for a Strategic Firefighting Advantage Zone in grassland and open woodland areas is that for at least 70% of the grassland fuel hazard must be \leq 50 when the grassland curing \geq 70% (refer to table below). Grassland curing levels are assessed using the guidelines developed by the Victorian Country Fire Authority (Garvey and Millie 1999). Grasses are generally 70% cured from early December; however long-term rainfall and temperature patterns do influence the growth habits of individual grass species. This influences the grass curing rate (Garvey and Millie 1999).

At 70% cured grasses can be described as straw with only the lower third of the stalk being green. At this stage most of the seed has also dropped from the seed head (Garvey and Millie 1999). Photos of 70% cured grass are in Garvey and Millie (1999).

Grassland Fuel Hazard

Height	Cover %									
(m)	10	20	30	40	50	60	70	80	90	100
0.1	1	2	3	4	5	6	7	8	9	10
0.2	2	4	6	8	10	12	14	16	18	20
0.3	3	6	9	12	15	18	21	24	27	30
0.4	4	8	12	16	20	24	28	32	36	40
0.5	5	10	15	20	25	30	35	40	45	50
0.6	6	12	18	24	30	36	42	48	54	60
0.7	7	14	21	28	35	42	49	56	63	70
0.8	8	16	24	32	40	48	56	64	72	80
0.9	9	18	27	36	45	54	63	72	81	90
1	10	20	30	40	50	60	70	80	90	100

Source: ACT Government 2014

References:

ACT Government (2014) *ACT Bushfire Management Standards ACT Strategic Bushfire Management Plan Version 3 2014*. Emergency Services Agency, Canberra.

Garvey, M. and Millie, S. (1999) *Grassland Curing Guide*. Victorian Country Fire Authority, Ballan.