

# Jarramlee Offset Management Plan

November 2013

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

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## Introduction

This offset management plan has been developed to meet the requirements of the approval decision for Block 2 Section 5 and Block 2 Section 13, Lawson, ACT (EPBC 2010/5549) under the Australian Government *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (Appendix A). As stipulated in condition 13 of the approval decision, this management plan includes:

- a map defining the location and boundaries of the offset area (Figure 1)
- measures to conserve the offset area in perpetuity as habitat for golden sun moth and natural temperate grassland
- details of the monitoring program for the golden sun moth and natural temperate grassland
- details of administration arrangements including record management, reporting and communication
- details of contingency measures should there be a measured decline in the quality and extent of golden sun moth habitat and natural temperate grassland.

This plan also guides the management of other conservation values present in Jarramlee that are not listed under the EPBC Act. This includes species listed under the ACT Government *Nature Conservation Act 1980*.

### 1.1 Review Date

The management actions outlined in this plan will be reviewed and updated in 2017. 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 and management requirements of the natural temperate grassland ecological community.

Any revision to the offset management plan will be submitted to the Commonwealth for approval by the Minister pursuant to condition 19 in the approval decision.

## 1. Offset Site Description

Jarramlee (112 hectares) is located on the northwestern boundary of the ACT (Figure 1). The reserve borders rural grazing land within both the ACT (agisted and leased land) and NSW (freehold). It is also less than 200 metres from the suburbs of Dunlop and West Macgregor. The property is contiguous with the West Macgregor offset site (EPBC 2010/5520), approximately 1.1 kilometres south-west of the Dunlop Grasslands Nature Reserve and 2.6 kilometres north-east of the Woodstock Nature Reserve (Figure 2).

Gooromon Ponds Creek and Ginninderra Creek converge within Jarramlee. Ginninderra Creek continues to flow west to the confluence with the Murrumbidgee River approximately 4.2 kilometres from the reserve.

### 2.1 Conservation Significance

Jarramlee is of high conservation significance, supporting a large population of the critically endangered golden sun moth and small patches of the endangered natural temperate grassland ecological community.

The natural temperate grassland is habitat of the Canberra raspy cricket (*Cooraboorama canberrae*). This cricket is endemic to Canberra and found generally in higher quality native grassland. Although not listed as a threatened species, the cricket generally occurs as small isolated populations restricted by highly fragmented habitat (Murray Darling Basin Commission n.d.).

Even-aged stands of *Eucalyptus* spp. (Appendix B) have been planted throughout the site. These trees are providing important habitat for locally threatened bird species such as the diamond firetail (*Stagonopleura guttata*) and hooded robin (*Melanodryas cucullata*).

The site is also habitat for a number of other threatened species listed under the *Nature Conservation Act 1980* (ACT) (Table 2).

Ginninderra Creek and Gooromon Ponds Creek are part of an important wildlife corridor providing important habitat for migratory birds such as the rainbow bee-eater (*Merops ornatus*) and the scared kingfisher (*Todiramphus sanctus*).

Both creeks also provide important habitat for other local fauna including the striped marsh frog (*Limnodynastes peronii*) and spotted grass frog (*Limnodynastes tasmaniensis*) which have been recorded during recent Frogwatch activities (Ginninderra Catchment Group 2013).

## 2.2 Significant Communities

Table 1: Significant Communities in Jarramlee

Community	EPBC Act 1999*	NC Act 1980**
Natural Temperate Grassland of the Southern Tablelands of NSW and the ACT	endangered	endangered

## 2.3 Significant Species

### 2.3.1 Fauna

Table 2: Significant Fauna in Jarramlee

Scientific Name	Common Name	EPBC Act 1999*	NC Act 1980**	Notes
<i>Synemon plana</i>	Golden sun moth	critically endangered	endangered	
<i>Cooraboorama canberra</i>	Canberra raspy cricket			Restricted species endemic to the Canberra area
<i>Hieraaetus morphnoides</i>	Little eagle		vulnerable	COG <sup>#</sup> record. Listed as vulnerable in NSW
<i>Lalage sueurii</i>	White-winged triller		vulnerable	COG <sup>#</sup> record. Listed as vulnerable in NSW

Scientific Name	Common Name	EPBC Act 1999*	NC Act 1980**	Notes
<i>Melanodryas cucullata</i>	Hooded robin		vulnerable	COG# record. Listed as vulnerable in NSW
<i>Merops ornatus</i>	Rainbow bee-eater	Migratory species		
<i>Rostratula benghalensis</i>	Painted snipe	vulnerable		Listed as vulnerable in NSW
<i>Stagonopleura guttata</i>	Diamond firetail	near threatened		Listed as vulnerable in NSW
<i>Artamus cyanopterus</i>	Dusky woodswallow			Regionally declining species
<i>Artamus superciliosus</i>	White-browed woodswallow			Regionally declining species
<i>Petroica phoenicea</i>	Flame robin			COG# record. Listed as vulnerable in NSW
<i>Epthianura albifrons</i>	White-fronted chat			COG# record. Listed as vulnerable in NSW

\*Australian Government Environment Protection and Biodiversity Conservation Act 1999

\*\*Nature Conservation Act 1980 (ACT)

# Canberra Ornithologists Group

Figure 1: Jarramlee Offset Area

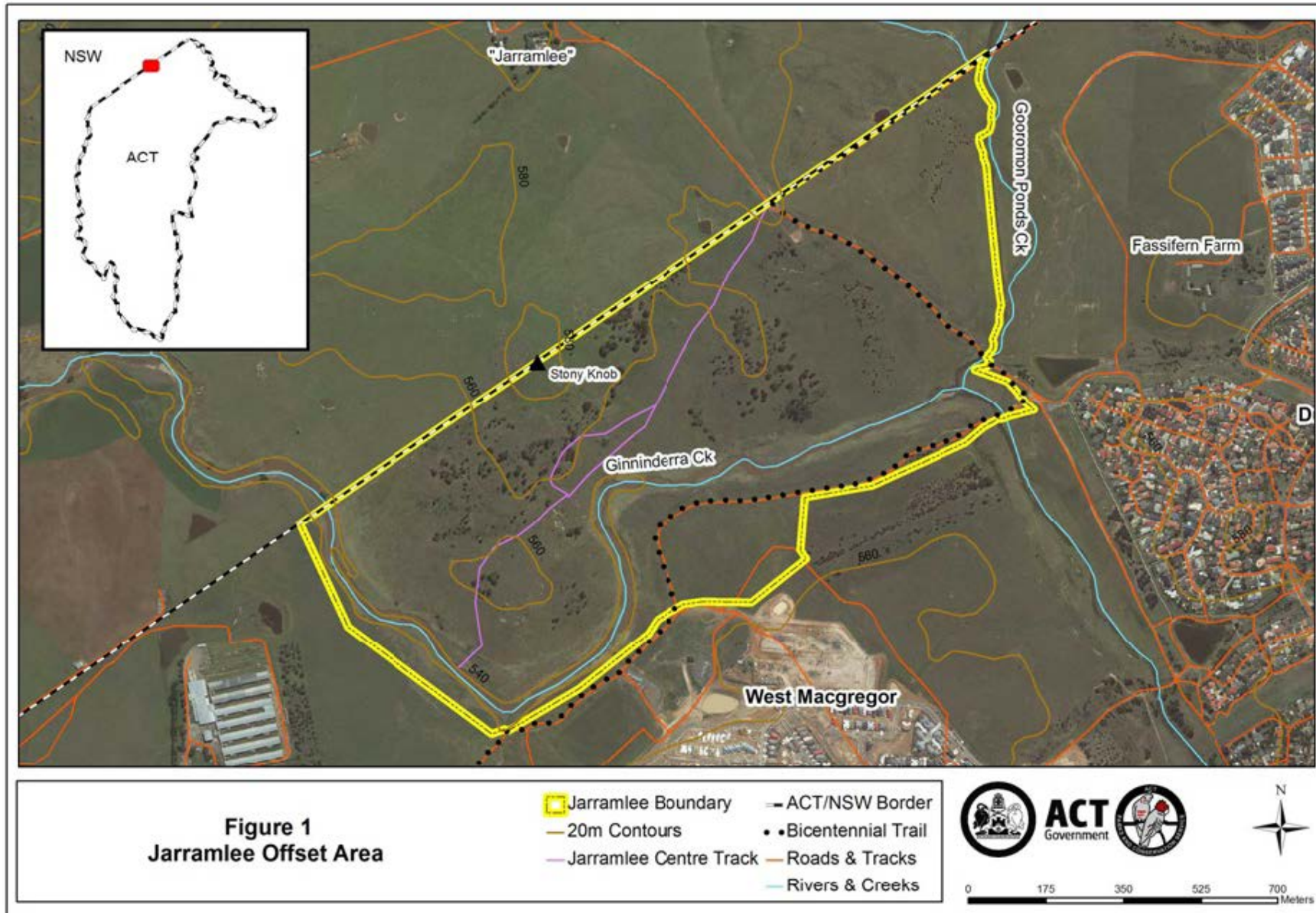
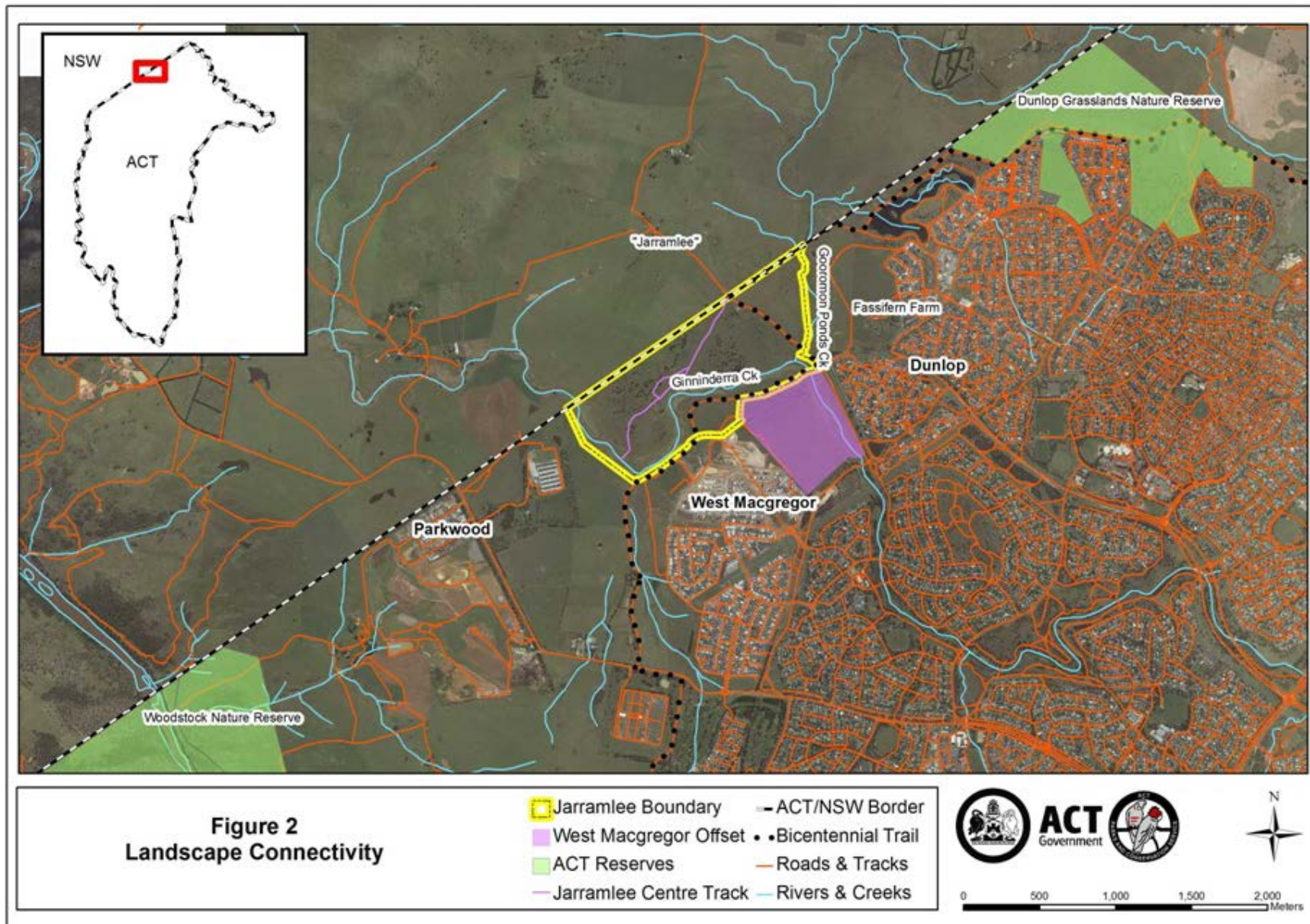


Figure 2: Landscape Connectivity



### **2.3.2 Flora**

No significant plant species have been recorded.

## **2.4 Connectivity**

Jarramlee is contiguous with the West Macgregor environmental offset site (EPBC2010/5520). It is also approximately 1.1 kilometres south-west of the Dunlop Grasslands Nature Reserve and 2.6 kilometres north-east of Woodstock Nature Reserve (Figure 2). Gooromon Ponds Creek and Ginninderra Creek form part of a riparian corridor through the reserve linking with the Murrumbidgee River Corridor approximately 4.2 kilometres to the west.

The Jarramlee and West Macgregor offset sites protect a relatively isolated patch of golden sun moth habitat within Canberra's rural-urban fringe (Figure 3). Nonetheless, this patch of golden sun moth habitat supports one of the largest known populations of golden sun moth in the ACT (Mulvaney 2012). Although currently isolated, there is potential to connect Jarramlee with the nearby golden sun moth population protected within the Dunlop Grasslands Nature Reserve and to patches of habitat along Gooromon Ponds Creek in NSW. Once established, this will create one of the largest patches of golden sun moth habitat in Australia (Mulvaney pers. comm. 2013).

Riparian protection and restoration works would also contribute towards enhancing habitat connectivity along the Ginninderra Creek and Gooromon Ponds Creek riparian corridors.

## **2.5 Cultural Heritage Values**

### **2.5.1 Aboriginal Cultural Heritage**

A large number of registered Aboriginal artefact scatters are recorded within Jarramlee. Disturbance to these artefacts should be avoided to prevent a breach of the ACT Government *Heritage Act 2004*.

The ACT Heritage Unit needs to be informed of all proposed operational or habitat restoration works which could potentially impact these artefact scatters. The ACT Heritage Unit will then advise ACT Parks and Conservation Service (PCS) on the approvals required and potential conditions which could be placed on the proposed works plan.

### **2.5.2 Historic Heritage**

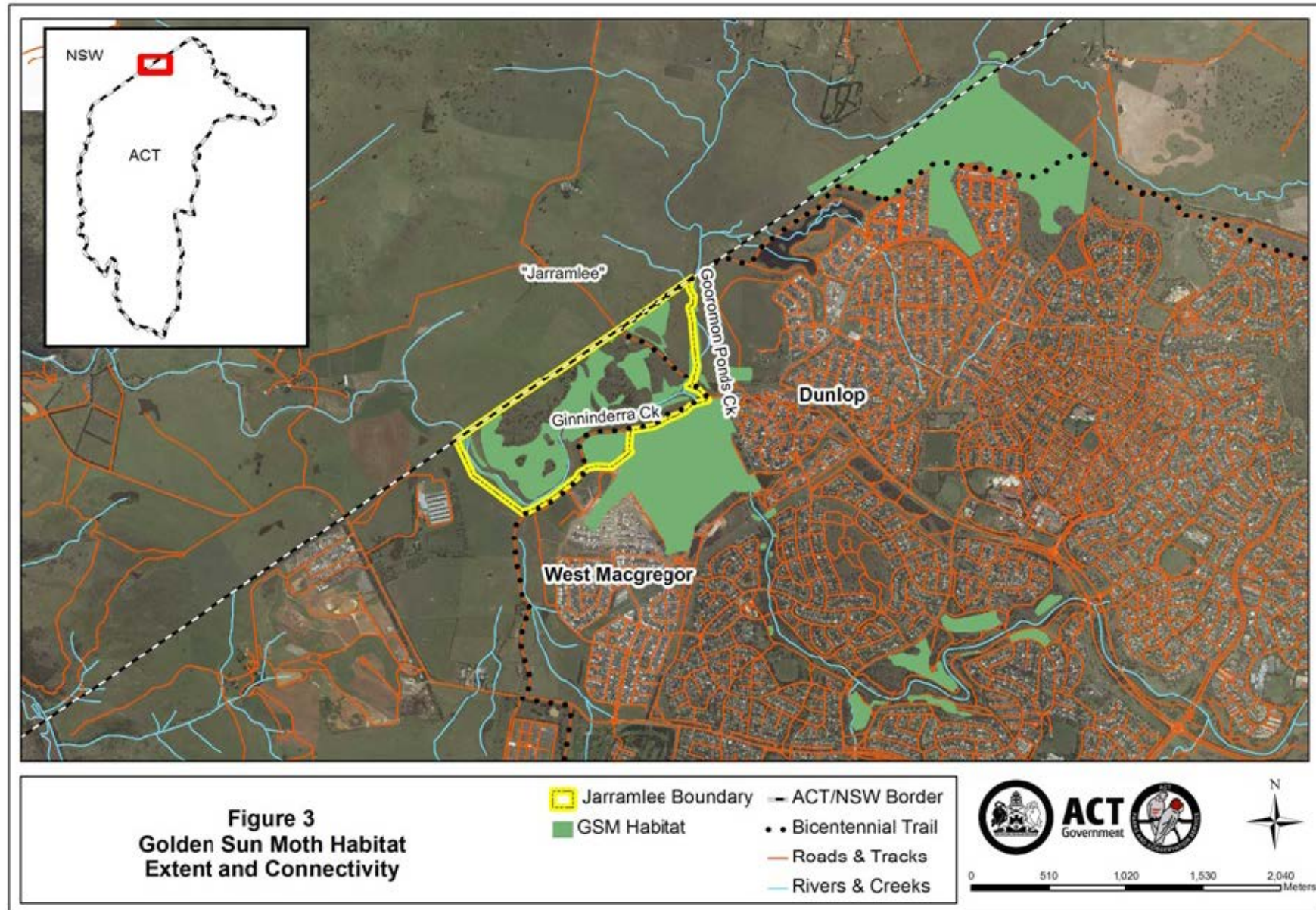
#### **The straight line border**

Stony Knob (590 metres) is the highest point on Jarramlee (Figure 1). It is also a trig point for the survey line between Mount Coree and One Tree Hill, which defines the straight section of the ACT/NSW border. The timber post fence which runs along the border following the Bicentennial National Trail in north-western portion of Jarramlee is likely to be the original fence constructed along the border in the 1920s (ACT Government 2011).

## **2.6 Recreation**

The Bicentennial National Trail traverses Jarramlee (Figure 1). This trail is suitable for horse riders, walkers and mountain bike riders. Dogs are permitted along the trail on a leash. No changes to the activities currently permitted along the trail will result from this plan.

Figure 3: Golden Sun Moth Habitat Extent and Connectivity



## **2.7 Community Involvement**

The Ginninderra Catchment Group (including the Jarramlee Park Landcare Group), Waterwatch and Frogwatch are actively involved in monitoring and improving local flora and fauna habitat along Gooromon Ponds Creek, Ginninderra Creek and the adjacent Fassifern Pond. Examples of activities undertaken by the groups include:

- water quality monitoring
- frog surveying and monitoring
- habitat restoration including woody weed control, revegetation and snag placement
- designing and installing community interpretation signage
- rubbish removal.

PCS will consult and engage with these groups to assist implement conservation management works within Jarramlee.

## **2.8 Infrastructure**

A sealed road leads over the border to the Jarramlee homestead. Overhead power lines cross the reserve. The Belconnen trunk sewer also traverses the reserve underground with access holes located along the south side of Ginninderra Creek (Figure 4).

All boundaries are fenced. This is with the exception of the eastern boundary (marked by Gooromon Ponds Creek). It is proposed that this will remain unfenced to assist manage the golden sun moth habitat along the Gooromon Ponds Creek riparian corridor.

Some sections of the existing boundary fence need repair or replaced. All north-south internal fences are stock-proof. Fences along the north side of Ginninderra Creek are in very poor condition (Figure 4). As part of this plan, it is proposed that Ginninderra Creek will be re-fenced and alternate stock water points installed. It is proposed that the fences be located to assist manage the biomass within the golden sun moth habitat.

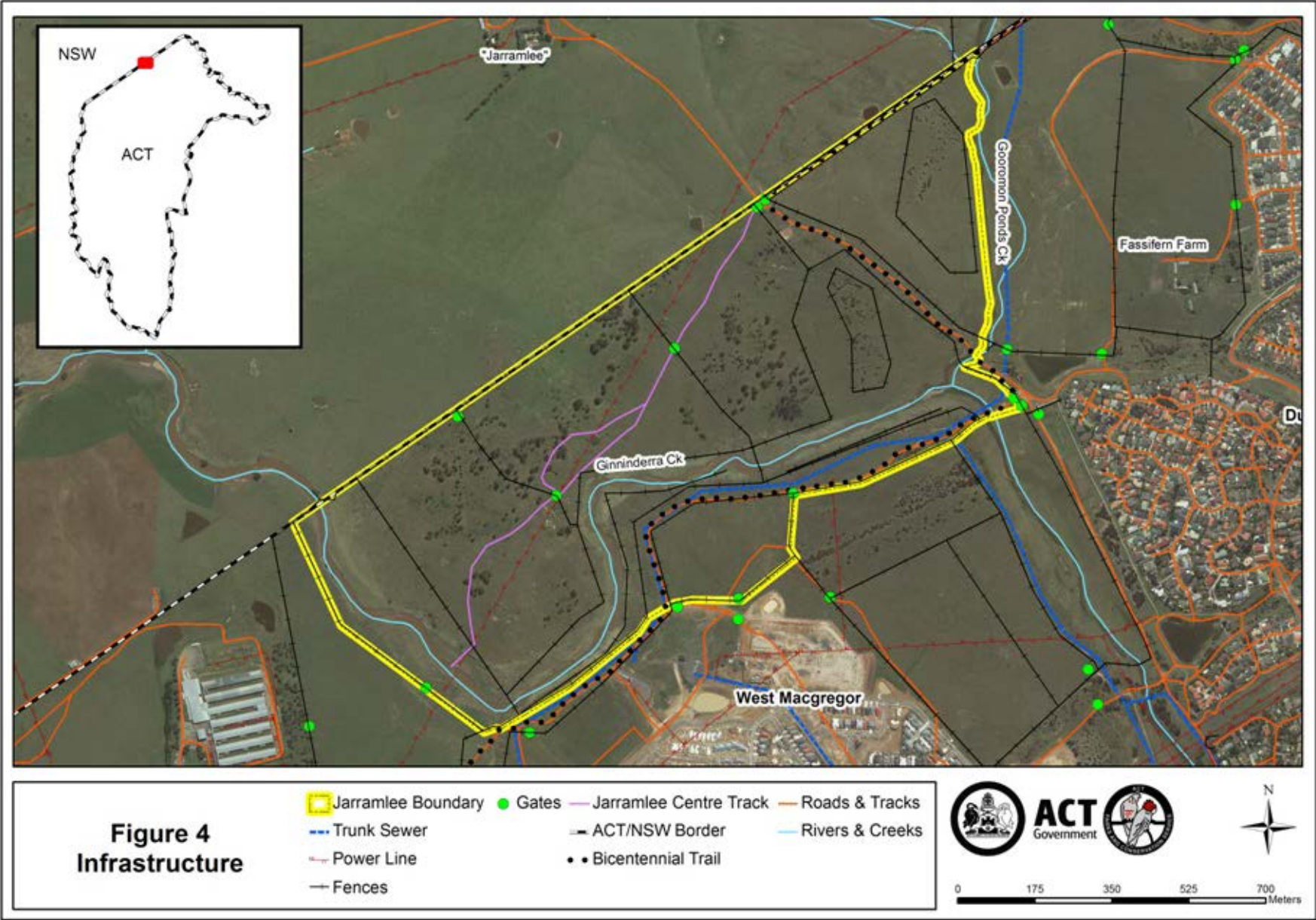
### **2.8.1 Vandalism**

The access gates along the Bicentennial National Trail are regularly vandalised.

## **2.9 Bushfire Management**

Jarramlee is within a strategic fire fighting advantage zone (ACT Government 2009) and may be subject to hazard reduction burns under the PCS Bushfire Operational Plan.

Figure 4: Infrastructure



## 2. Strategic Context

The management and recovery of golden sun moth and natural temperate grassland in the ACT is directed by *Action Plan No. 28 – ACT Lowland Native Grassland Conservation Strategy* (ACT Government 2005).

Action Plan 28 details the actions and performance criteria for the conservation of natural temperate grassland and grassland fauna, including the golden sun moth. The priority tasks identified in this report include:

For natural temperate grassland:

- to include viable areas of natural temperate grassland in the reserve system
- avoid further fragmentation
- increase ecological connectivity
- protect areas with a range of genetic variability of remaining species populations
- restore patches of vegetation with a low botanical significance rating
- explore opportunities to restore substantially modified grasslands and habitat for threatened species
- increase the area of occupancy of threatened flora and fauna, particularly where these have small populations or restricted distributions (ACT Government 2005).

For golden sun moth:

- protect in perpetuity the existing viable populations of golden sun moth in secure native grassland habitat across the range of the species in the ACT
- maintain the potential of the species for evolutionary development in the wild (ACT Government 2005).

To achieve this, the report recommends the following conservation actions:

- conduct further survey to accurately determine the area of occupancy
- research the biology and ecology of golden sun moth as the basis for adaptively managing the species and its habitat
- monitor golden sun moth habitat and populations at major sites, including the impacts of management practices (particularly grazing)
- protect key habitat known to support populations across their range in the ACT, noting that insufficient information is known about what constitutes a viable population (ACT Government 2005; Mulvaney 2012).

This management plan will contribute to addressing all of these priorities.

## 3. Process for Incorporating Jarramlee into Canberra Nature Park

Jarramlee will be incorporated into Canberra Nature Park by way of a variation to the Territory Plan. This includes protecting the area with the inclusion of 'Pc-a nature reserve' overlay and rezoning of the blocks currently zoned as 'Urban Open space' (PRZ1) to non-urban 'Hills, Ridges and Buffer' (NUZ3). Refer to the Lawson Offset Strategy for the timing of the variation to the Territory Plan.

Once incorporated into Canberra Nature Park it will be required that the site is managed in accordance with the objectives of the Canberra Nature Park Plan of Management, a statutory plan prepared in accordance with the *ACT Planning and Development Act 2007*.

## **4. Funding of Conservation Measures**

The Territory and Municipal Services (TAMS) Directorate will receive a minimum of \$972,000 by the ACT Government to implement the proposed management activities within section 11 of this offset management plan. This is pursuant to condition 12b in the approval decision.

## **6. Monitoring Plan**

### **6.1 Monitoring Golden Sun Moth Habitat and Natural Temperate**

Surveying golden sun moth populations is inherently difficult due to their sporadic emergence during the flight season. As a result, surveyed populations of golden sun moth within individual sites have fluctuated from year to year, making changes in the population very difficult to assess.

Until a more accurate direct surveying method for golden sun moth is determined, the ACT Government will primarily focus on monitoring the quality and extent of golden sun moth habitat within Jarramlee. Such monitoring will also pick up on any changes to the quality and extent of natural temperate grassland within Jarramlee.

The ACT Government will nonetheless, engage a suitably qualified expert to survey the golden sun moth population in Jarramlee at least once in every five year period using the ACT Government golden sun moth survey guidelines (ACT Government 2010b). Priority will be given to surveying golden sun moth populations in years where emergence of golden sun moth in other sites in the ACT is high. This last occurred in 2009.

The extent and quality of golden sun moth habitat and natural temperate grassland within Jarramlee has been mapped (Figures 5 and 6) (Rowell 2013a) following the ACT Government guidelines for surveying golden sun moth habitat and lowland vegetation communities (ACT Government 2010a and ACT Government 2010b). These maps highlight the presence of several grassland and golden sun moth habitat classes and provide a baseline from which to determine changes in the extent of golden sun moth habitat and natural temperate grassland over time.

Monitoring plots will be established to assess golden sun moth habitat and natural temperate grassland quality within Jarramlee. These plots will be located within each of the golden sun moth habitat and natural temperate grassland quality classes (Rowell 2013a) and will be assessed by suitably qualified expert.

Rowell (2013b) provides examples of corrective actions to be undertaken if the golden sun moth habitat parameters across all plots fall below baseline level (Table 3).

Figure 5: Grassland Quality and Extent

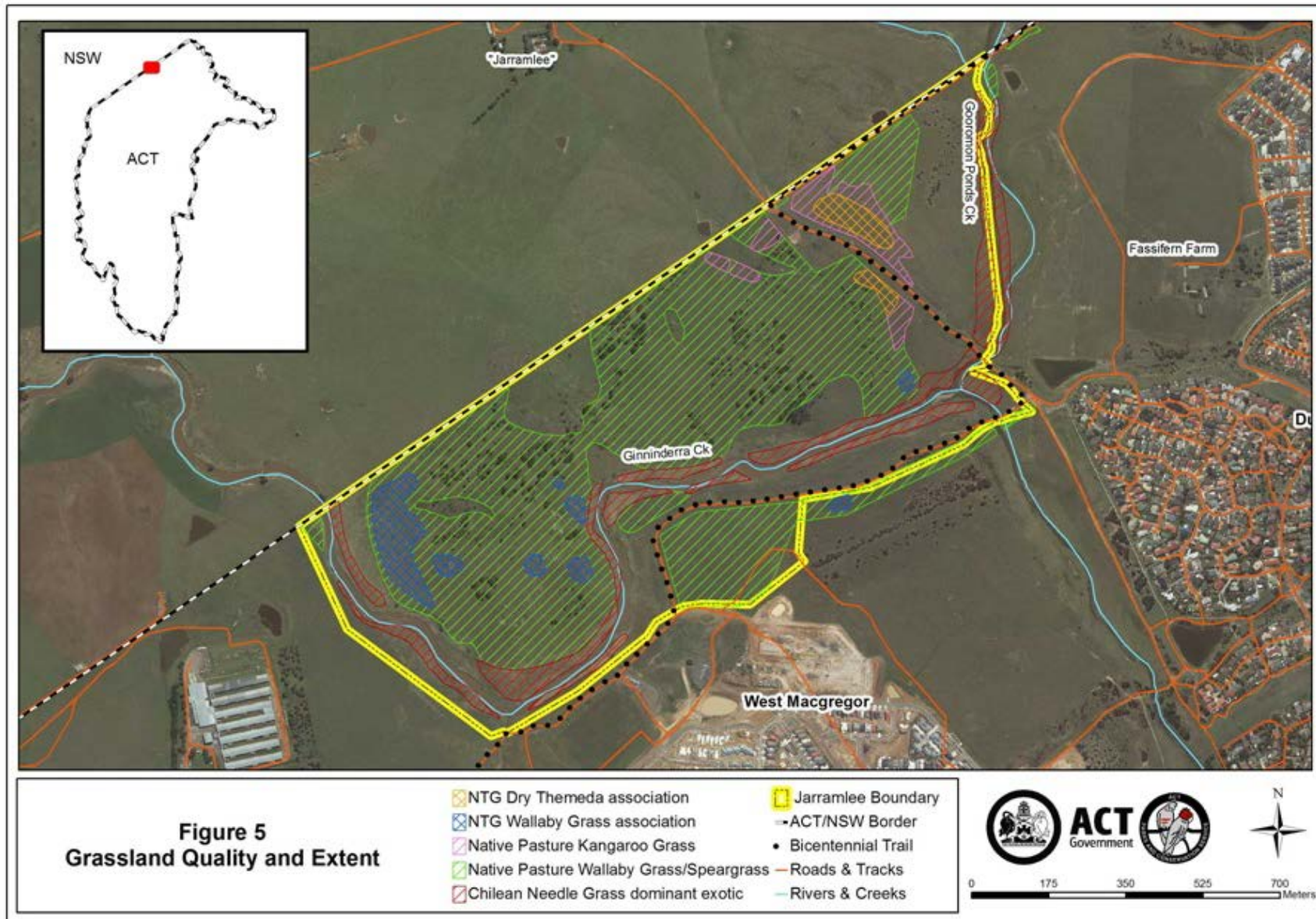


Figure 6: Golden Sun Moth Habitat Quality and Extent

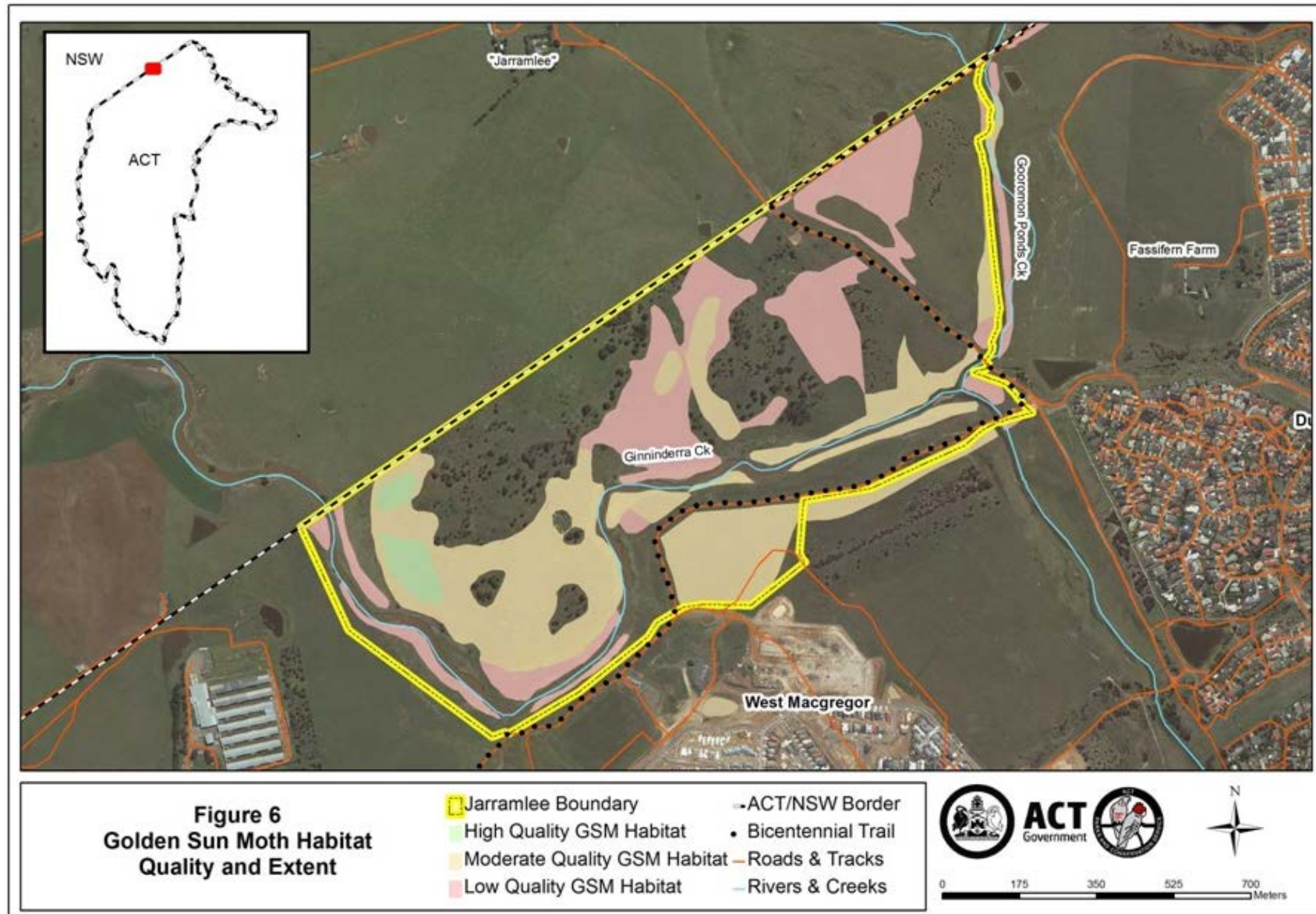


Table 3: Triggers and corrective actions to improve golden sun moth habitat extent and quality

Habitat parameter	Trigger	Corrective Action
Native C3 perennial grasses	<55% cover	Increase weed control
	>65% cover	Increase grazing (or undertake fuel reduction burn if appropriate)
Bare ground	<5% cover	Increase grazing (or undertake fuel reduction burn if appropriate)
	>15% cover	Reduce grazing
Litter	<5% cover	Reduce grazing
	>15% cover	Increase grazing (or undertake fuel reduction burn if appropriate)
Exotic species	>5% cover	Increase weed control

## 6.2 Monitoring other Conservation Values

Individual volunteers and community groups regularly monitor bird and frog populations within Jarramlee and the surrounding area. PCS is supportive of these community activities and acknowledges the contribution they are making towards improving our land management capabilities. Information collected by community volunteers will assist guide conservation management objectives within Jarramlee.

## 6.3 Photo Monitoring Points

Photo monitoring points will be established within each of the proposed monitoring plots and at other locations of interest throughout Jarramlee. Photo monitoring points will be established following the method outlined in ACT Government (2013).

## 6.4 Monitoring Schedule

The extent and quality of golden sun moth habitat and natural temperate grassland will be re-mapped in 2015 and then every four years thereafter, until the expiry of the approval decision.

As outlined in section 6.1, the golden sun moth population will be surveyed at least once in every five year period. Surveying may be more frequent with priority given to surveying golden sun moth populations in years where emergence in other sites in the ACT is high. This last occurred in 2009 when golden sun moths were surveyed with higher densities along the creek flats within Jarramlee. The golden sun moth population will be surveyed again before the end of the 2014 flight season.

## 7. Contingency Measures

PCS and Conservation, Planning and Research (CPR) will re-evaluate the current strategy used to manage golden sun moth and natural temperate grassland in Jarramlee if, as a result of the monitoring program it is determined that:

- the extent and /or quality of the golden sun moth habitat (including natural temperate grassland) has declined from baseline level, or
- the golden sun moth population is significantly lower than other populations surveyed in the ACT within the same year (relative to previous golden sun moth survey results at Jarramlee).

Contingency options:

- utilise alternate biomass management techniques such as burning or adjusting stock rates
- invest more resources into weed control or other issues identified in the monitoring process
- supplement the existing golden sun moth population by translocating larvae from an identified development site (dependant on results of current golden sun moth translocation research)
- invest further resources into researching golden sun moth habitat requirements.

## 8. Adaptive Management

PCS and CPR are committed to adaptively managing the golden sun moth and natural temperate grassland within Jarramlee. This includes adapting conservation and land management practises in response to results from the monitoring program (section 6) and to unforeseen or unplanned management threats and issues, as well as to reflect advances in ecological research and land management technologies.

## 9. Conservation Assets

### 9.1 Natural Temperate Grassland

**Distribution:** Small patches of natural temperate grassland are located primarily within the northeastern and western corners of the reserve (Figure 5).

**Area:** 4.65 hectares

#### 9.1.1 Description

Natural temperate grasslands are dominated by native perennial tussock grass species. Dominant species often include kangaroo grass (*Themeda australis*), wallaby grasses (*Rytidosperma* spp.) and spear grasses (*Austrostipa* spp.). Red-leg grass (*Bothriochloa macra*) and tussock grasses (*Poa* spp.) are also common. Natural temperate grasslands also have a diverse herbaceous layer (forbs) which may comprise up to 70% of species present. The community occurs at altitudes between 560 and 1200 metres in naturally treeless valleys which are influenced by cold air drainage and in broad valleys (Environment ACT 2005).

Jarramlee includes small patches of natural temperate grassland dominated by either kangaroo grass (*Themeda australis*) or wallaby grass (*Rytidosperma* sp.) (Figure 5). These patches are surrounded by lower quality native pasture. Rehabilitation of these areas could lead to an increase in the extent of natural temperate grassland (Rowell 2013a).

## 9.2 Golden Sun Moth

**Distribution:** Golden sun moth habitat is present over the majority of Jarramlee (Figure 6).

**Area:** High quality habitat: 1.8 hectares

Medium quality habitat: 26.4 hectares

Low quality habitat: 19.96 hectares

### 9.2.1 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 centimetres and a tapered abdomen. Males are slightly larger than females. The sexes can be 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 (DEWHA 2009). 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 (Gilmore and Mueck 2010).

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 (Gilmore 2011 and ACT Government 2005).

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).

### 9.2.2 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. (2011) 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, adjacent to Jarramlee, Downey and Sea (2012) also found the highest larvae densities under the Chilean needle grass tussocks (5-8 individuals/m<sup>2</sup> compared to <2 individuals/m<sup>2</sup> 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.

### 9.3 Other Conservation Assets

#### 9.3.1 Birds

Numerous birds have been recorded in Jarramlee and within the surrounding area (Appendix C). These include many woodland and grassland birds such as the vulnerable white-winged triller (*Lalage sueurii*), diamond firetail (*Stagonopleura guttata*) and brown songlark (*Cinchorhamphus cruralis*).

Jarramlee also provides important habitat for the vulnerable little eagle (*Hieraaetus morphnoides*). A deserted nest is present in the western paddock indicating that this species has nested in Jarramlee in recent years.

The majority of the bird observations within Jarramlee have been in the planted woodlots. They are providing important nesting and foraging habitat and increasing landscape habitat connectivity.

The dusky woodswallow (*Artamus cyanopterus*), white-browed woodswallow (*Artamus superciliosus*), diamond firetail (*Stagonopleura guttata*) and rainbow bee-eater (*Merops ornatus*) have all been observed feeding in Jarramlee (Rowell 2013a).

#### 9.3.2 Canberra Raspy Cricket

Several active burrows of the Canberra raspy cricket (*Cooraboorama canberrae*) have been observed within the northwestern part of Jarramlee (Rowell 2013a).

The Canberra raspy cricket is a grassland species found only in the ACT, with the exception of one record near Queanbeyan. Little is known about the habitat requirements or life cycle of the species however, they are known to typically remain in their nests during the day and forage for food at night (Murray Darling Basin Commission n.d.).

Once common in the grasslands of the ACT, the species is less common due to urban development and habitat degradation.

The Canberra raspy cricket digs vertical spherical burrows up to 60 centimetres deep. These burrows are lined with a silk-like substance that assists to stabilise the burrow walls. The endangered grassland earless dragon (*Tympanocryptis pinguicolla*) often uses disused burrows of the Canberra raspy cricket (Murray Darling Basin Commission n.d. and Rowell 2013a)

## 10. Management Issues

Management issues which are or have potential to impact on the conservation values in Jarramlee are:

- pest plants and animals (except Chilean needle grass in golden sun moth habitat zones)
- inadequate biomass management
- regeneration or revegetation
- further fragmentation of natural temperate grassland and golden sun moth habitat
- soil disturbance and erosion
- direct human disturbance.

### 10.1 Pest Plants and Animals

The diversity and extent of exotic species within Jarramlee is high. The site is dominated by exotic grasses and forbs (Appendix B) and includes 3 weeds of national significance: blackberry (*Rubus fruticosus*), serrated tussock (*Nassella tricotoma*) and Chilean needle grass.

Eighteen per cent of golden sun moth habitat within Jarramlee is currently dominated Chilean needle grass (Figure 6). Despite its classification as a weed of national significance, Chilean needle grass is currently an important golden sun moth habitat in Jarramlee. Consideration is needed to ensure that Chilean needle grass control in Jarramlee is undertaken in a manner which will have limited impact on the golden sun moth. It is anticipated that current research by the University of Canberra will provide some insight into how to best control Chilean needle grass within Jarramlee.

Woody weeds such as blackberry, hawthorn (*Crataegus monogyna*) and firethorn (*Pyracantha* sp.) are common throughout Jarramlee. These plants are providing important habitat for woodland birds. Care needs to be taken to minimise the impact on woodland bird populations when controlling these weeds.

There are three known rabbit warrens within the main section of Jarramlee. Further warrens are likely to be present.

### 10.2 Biomass Management

Jarramlee is currently grazed by cattle. Stocking rates have been low and in some sections, the biomass is high. Kangaroos are present, however they are not significantly impacting on the cover of understory species within Jarramlee.

Cattle grazing will continue within Jarramlee, however other biomass management methods (including burning) may be used. A biomass management plan will be developed to suit the golden sun moth habitat requirements and to encourage greater diversity and cover of forbs within the natural temperate grassland.

The PCS Fire Management Unit will be involved in developing the biomass management plan to ensure that biomass levels are maintained as per the fuel management standards for the strategic fire fighting advantage zone (Appendix D).

#### 10.2.1 Fire

It is unclear what impact fire has on the golden sun moth, however fire at a critical life-cycle stage is likely to negatively impact a golden sun moth population. Any prescribed burn would therefore need to occur in autumn or winter, after eggs have hatched and before adult moths emerge.

Autumn burns are also preferential within the natural temperate grassland community.

### **10.3 Regeneration or Revegetation**

The planted woodlots within Jarramlee are providing important bird habitat. This habitat can be improved by under planting with indigenous shrubs. Revegetation or regeneration of trees outside the existing woodlot areas could negatively affect the golden sun moth, which requires an open grassland environment.

Revegetation of riparian trees and shrubs is permissible in small clumps along Ginninderra Creek, avoiding golden sun moth habitat.

### **10.4 Habitat Fragmentation**

One of the main objectives of this plan is to improve the management of the conservation values within Jarramlee, thereby preventing further fragmentation of golden sun moth habitat and natural temperate grassland.

To improve the connectivity of golden sun moth habitat, a grassland rehabilitation project is proposed linking Jarramlee with the Dunlop Grasslands Nature Reserve (Figure 7). This project has potential to increase the existing golden sun moth habitat within Jarramlee and Dunlop Grasslands Nature Reserve by five hectares, creating one of the largest patches of golden sun moth habitat in Australia.

The quality and extent of the existing golden sun moth habitat and natural temperate grassland within Jarramlee will be improved through active weed control and biomass management. This includes improving sections along the Bicentennial National Trail and Ginninderra Creek floodplain.

### **10.5 Soil Disturbance**

Jarramlee will be managed to avoid instances of heavy soil disturbance. This includes limiting vehicle access across the site during or after rain periods.

Under the *Planning and Development Act 2007* an Environmental Impact Statement (EIS) may be required for any works which could impact the soil or vegetation within Jarramlee.

### **10.6 Erosion**

The banks of Ginninderra Creek and Gooromon Ponds Creek need to be assessed for erosion from cattle and floodwaters. Some instability is present at the confluence of Ginninderra Creek and Gooromon Ponds Creek. There were no signs of significant erosion elsewhere within the reserve.

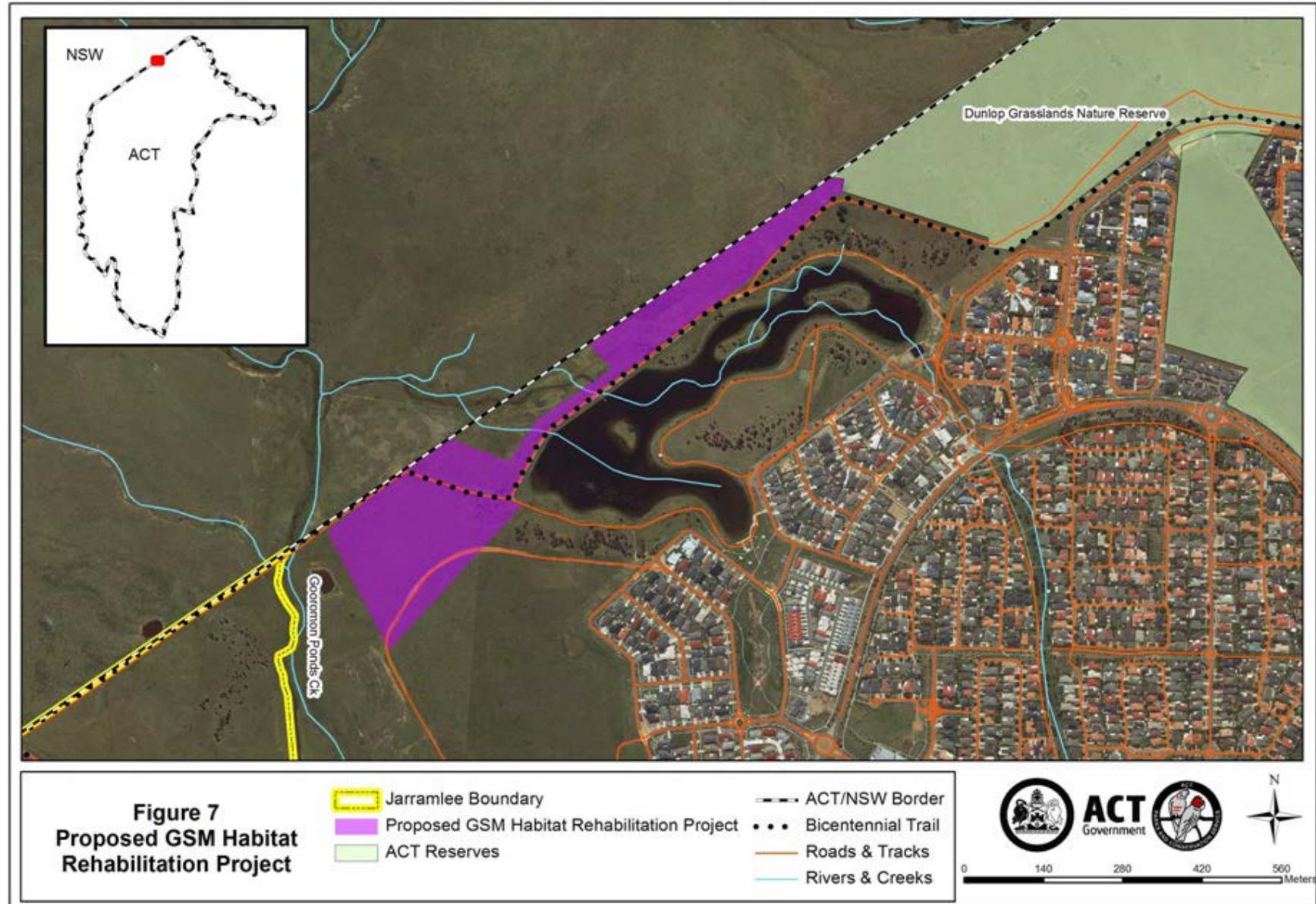
### **10.7 Physical Disturbance**

#### **10.7.1 Community Access**

Community usage is currently low and primarily concentrated along the Bicentennial National Trail. It is proposed that no new public access tracks will be developed within other sections of Jarramlee and public access into other sections of the reserve will not be promoted. It is proposed that community access to the reserve (with the exception access along the Bicentennial National Trail) be limited to co-ordinated community group activities that benefit the management of the reserve.

Community interpretation signage will be installed along the Bicentennial National Trail to inform the community of the presence of the golden sun moth and the need to minimise the impact on the species.

Figure 7: Proposed GSM Habitat Rehabilitation Project



### **10.7.2 Management and Emergency Access**

Vehicle access is currently limited to the Bicentennial National Trail and via the centre track within the main section of Jarramlee (Figure 1). It is proposed that no new tracks are established within Jarramlee.

Management vehicles and machinery access should be restricted within the golden sun moth habitat and the natural temperate grassland community with the exception of slashers along the Bicentennial National Trail. To limit soil compaction and physical disturbance to the golden sun moth, access by slashers to the golden sun moth habitat along the Bicentennial National Trail should be avoided when soil moisture is high.

Maintenance activities (including weed control, slashing and fuel reduction burns) should occur, where possible, outside the golden sun moth flight season and peak flowering season within the natural temperate grassland community (October to early January).

## 11. Management Actions

### 11.1 Planning and Survey Works Plan

Activity	Description	Responsibility	Estimated timeframe for completion	Estimated budget <sup>#</sup>	Estimated on-going operational costs (p.a.) <sup>#</sup>
Biomass Management Plan (for ecological and bushfire fuel reduction purposes)	<p>The plan will guide:</p> <ul style="list-style-type: none"> <li>• The grazing and/or burning regime to maintain understory biomass at levels that benefit the golden sun moth and natural temperate grassland as well as comply with the requirements of a strategic fire fighting advantage zone.</li> <li>• The location of internal fences along Ginninderra Creek and/or Gooromon Ponds Creek to ensure the biomass within the golden sun moth habitat along the riparian corridor can be appropriately managed.</li> <li>• The installation of stock grazing infrastructure.</li> </ul>	ACT Parks and Conservation Service (PCS)(including PCS Fire Management Unit) and Conservation, Planning and Research (CPR)	2013-14	In-kind contribution	In-kind contribution
Consult with ACT Heritage Unit	<ul style="list-style-type: none"> <li>• Inform the ACT Heritage Unit of operational or habitat restoration works which could impact Aboriginal scatters recorded in Jarramlee.</li> <li>• Seek advice from the ACT Heritage Unit prior to upgrading the fence on the ACT/NSW border along the Bicentennial National Trail.</li> </ul>	PCS	As needed	In-kind contribution	In-kind contribution

## 11.2 Capital Improvements Works Plan

Proposed Activity <sup>#</sup>	Description of Proposed Works <sup>#</sup>	Responsibility	Estimated timeframe for completion	Estimated Budget <sup>#</sup>	Estimated On-going Operational Costs (p.a.) <sup>#</sup>
Fencing	<ul style="list-style-type: none"> <li>• Upgrade to “vandal resistant” gates along Bicentennial National Trail.</li> <li>• Repair or replacement other boundary fences as needed.</li> <li>• Fence off Ginninderra and /or Gooromon Ponds Creek as guided by the biomass management plan to protect stream banks from stock trampling.</li> <li>• The ACT Heritage Unit needs to be advised of any planned upgrade or replacement to the heritage fence on the ACT/NSW border fence along the Bicentennial National Trail.</li> </ul>	PCS	2014-15	\$75,000	\$5,000
Stock Grazing Preparation	Install mains fed troughs to supply stock water from Ginninderra Creek and Gooromon Ponds Creek	PCS	2014-15	\$80,000	\$2,000
Signage	Design, construct and install reserve signage to identify the reserve to the public including use related information.	PCS	2014-15	\$10,000	\$2,000

### 11.3 Environmental Restoration and Research Plan

Activity	Description of Proposed Works	Responsibility	Estimated timeframe for completion	Estimated budget <sup>#</sup>	Estimated on-going operational costs (p.a.) <sup>#</sup>
Riparian restoration	<ul style="list-style-type: none"> <li>• Undertake stream bank protection works at the confluence of Ginninderra Creek and Gooromon Ponds Creek to protect golden sun moth habitat from erosion.</li> <li>• Revegetate with indigenous shrubs within other sections of the riparian zone to provide habitat for woodland and migratory birds. Planting should be done in small patches along the riparian corridor avoiding golden sun moth habitat.</li> <li>• Seek advice from CPR on plant species selection and on the location of the revegetation works.</li> </ul>	PCS, CPR and a suitably qualified contractor and/or community group	2015-16	\$20,000	-
Connectivity and golden sun moth Habitat Restoration	Engage an external contractor to rehabilitate the area between Jarramlee and Dunlop Grasslands Nature Reserve to improve golden sun moth habitat connectivity (Figure 7).	PCS, CPR and a suitably qualified grassland restoration expert	2016-17	\$250,000	-
Golden sun moth Research	Research into golden sun moth life cycle, habitat requirements or translocation.	PCS, CPR and the University of Canberra	2015-16	\$70,000	-

#### 11.4 On-going Operational Works Plan

Proposed Activity	Description of Proposed Works	Responsibility	Estimated timeframe for completion	Estimated budget <sup>#</sup>	Estimated on-going operational costs (p.a.) <sup>#</sup>
Weed control	<ul style="list-style-type: none"> <li>• Reduce the impact of weeds of concern, namely: serrated tussock, St John's wort, African love grass, Patterson's curse, sweet briar, blackberry and saffron and scotch thistles.</li> <li>• Until results on the current research on Chilean needle grass control within golden sun moth habitat are available, Chilean needle grass control should be limited to areas outside of golden sun moth habitat.</li> <li>• To minimise impact on woodland bird habitat, control large woody weeds in a phased approach including control methods such as stem injection or frill poison to leave temporary standing structure. Protect native plant species from off-target damage.</li> <li>• To maintain an open grassland structure regenerating trees and shrubs should be removed from outside woodlots.</li> </ul>	PCS	2013-14 2014-15 2015-16 2016-17	\$30,000 \$20,000 \$15,000 \$15,000	\$15,000
Vertebrate pest control (Rabbits)	<ul style="list-style-type: none"> <li>• Undertake a low risk control program.</li> <li>• Spotlight counts in spring and autumn.</li> <li>• Map active warrens in winter and control rabbits in spring.</li> <li>• Follow up control may be necessary.</li> </ul>	PCS	2013-14 2014-15 2015-16 2016-17	\$10,000 \$5,000 \$5,000 \$5,000	\$5,000

### 11.5 Monitoring Golden Sun Moth and Natural Temperate Grassland

Activity	Description	Responsibility	Timeframe	Estimated budget <sup>#</sup>	Estimated on-going operational costs (p.a.) <sup>#</sup>
Monitoring extent and quality of golden sun moth habitat and natural temperate grassland	The extent and quality of golden sun moth habitat and natural temperate grassland will be re-mapped in 2015 and then every four years thereafter.	PCS to engage a suitably qualified expert	2015 then every 4 years thereafter	\$150,000	-
Monitoring golden sun moth population	The golden sun moth population will also be surveyed once in every five year period. Priority will be given to undertaking these surveys in years where emergence of golden sun moth in other sites in the ACT is high. This last occurred in 2009.	PCS to engage a suitably qualified expert	By the end of the 2014 flight season and then once in every 5 year period thereafter	\$50,000	-

### 11.6 Management Resources

Activity	Description	Responsibility	Timeframe	Estimated budget <sup>#</sup>	Estimated on-going operational costs (p.a.) <sup>#</sup>
Staffing	To deliver the actions outlined in this plan resources to support 0.5 FTE of a Senior Ranger (Ranger Grade 3) position and vehicle are required for the first 3 years and 0.2 FTE each year after.	PCS	2014-15 2015-16 2016-17	\$54,000 \$54,000 \$54,000	\$21,600
			<b>Total</b>	<b>\$972,000</b>	<b>\$50,600</b>

<sup>#</sup>Note: The estimated costs to deliver on the proposed works are based on current information from experienced PCS staff who manage reserves with similar land management issues and from quotes received by experienced service providers to undertake works in Jarramlee. Some variation to these estimates is, however, likely due to factors such as external environmental influences (e.g. climate, pest plant and animal population dynamics), increased material costs increased contractor costs etc.

## 12. Record Management and Reporting

PCS will manage all records relating to actions outlined in this plan. Pursuant to condition 17 in the approval decision, a report on the implementation of the management plan will be published and maintained on the TAMS website by the 12<sup>th</sup> December each year, with the first report due on the 12<sup>th</sup> December 2014.

Documentary evidence providing proof of the date of publication and any non-compliance of any of the conditions within the approval decision will be submitted to the Commonwealth at the same time as the report is published.

## 13. References

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**Appendix A: Approval Decision Blocks 1 and 2, Belconnen, ACT (EPBC 2010/5549)**

The approval decision is available at the [Department of Environment website](#).

## Appendix B: Flora Species List

Scientific Name	Common Name
<b>Trees</b>	
<i>Eucalyptus cinerea</i>	Mealy Stringybark
<i>Eucalyptus globulus</i>	Southern Blue gum
<i>Eucalyptus mannifera</i>	Brittle Gum
<i>Eucalyptus tricarpa</i>	Ironbark
<b>Shrubs</b>	
<i>Acacia dealbata</i>	Silver Wattle
<i>Acacia rubida</i>	Red-stemmed Wattle
<i>Cassinia quinquefaria</i>	Cassinia
<b>Native Grasses</b>	
<i>Aristida ramosa</i>	Wiregrass
<i>Rytidosperma caespitosa</i>	Ringed Wallaby Grass
<i>Rytidosperma carphoides</i>	Short Wallaby Grass
<i>Rytidosperma eriantha</i>	Hill Wallaby Grass
<i>Rytidosperma levis</i>	Smooth Wallaby Grass
<i>Rytidosperma penicillata</i>	Slender Wallaby Grass
<i>Rytidosperma pilosa var pilosa</i>	Velvet Wallaby Grass
<i>Rytidosperma sp.</i>	Wallaby Grass
<i>Austrostipa bigeniculata</i>	Tall Spear Grass
<i>Austrostipa scabra</i>	Rough Speargrass
<i>Bothriochloa macra</i>	Redleg Grass
<i>Chloris truncate</i>	Windmill Grass
<i>Dichelachne crinita</i>	Longhair Plumegrass
<i>Dichelachne sieberiana</i>	A Plumegrass
<i>Dichelachne sp.</i>	A Plumegrass
<i>Elymus scaber</i>	Common Wheat Grass
<i>Eragrostis benthamii</i>	A Lovegrass
<i>Microlaena stipoides</i>	Weeping Grass
<i>Panicum effusum</i>	Hairy Panic Grass
<i>Poa labillardierii</i>	Tussock Grass
<i>Poa sieberiana</i>	Snowgrass
<i>Sorghum leiocladum</i>	Wild Sorghum
<i>Themeda australis</i>	Kangaroo Grass
<b>Native Herbs</b>	
<i>Acaena sp.</i>	Sheeps Burr
<i>Asperula conferta</i>	Common Woodruff
<i>Chamaesyce drummondii</i>	Caustic Weed
<i>Chenopodium pumilio</i>	Crumbweed
<i>Chrysocephalum apiculatum</i>	Yellow Buttons
<i>Chrysocephalum semipapposum</i>	Common Everlasting
<i>Convolvulus angustissimus</i>	Australian Bindweed
<i>Cymbonotus lawsonianus</i>	Bears Ears
<i>Desmodium varians</i>	Slender Tick Trefoil
<i>Dichondra repens</i>	Kidney Weed
<i>Dichopogon fimbriatus</i>	Nodding Chocolate Lily
<i>Einadia nutans</i>	Climbing Saltbush
<i>Epilobium billardierianum</i>	Willow Herb
<i>Eryngium rostratum</i>	Blue Devil
<b>Native Herbs (continued)</b>	
<i>Euchiton involucratus</i>	Star Cudweed

**Scientific Name**

*Euchiton sphaericus*  
*Geranium sp.*  
*Glycine tabacina*  
*Gnaphalium sp.*  
*Gonocarpus tetragynus*  
*Goodenia pinnatifida*  
*Haloragis heterophylla*  
*Hypericum gramineum*  
*Leptorhynchus squamatus*  
*Oxalis perennans*  
*Plantago varia*  
*Rumex brownii*  
*Rumex dumosus*  
*Senecio quadridentatus*  
*Solenogyne dominii*  
*Tricoryne elatior*  
*Vittadinia cuneata*  
*Vittadinia muelleri*  
*Wahlenbergia communis*  
*Wahlenbergia gracilentia*  
*Wahlenbergia luteola*

**Common Name**

Star Cudweed  
 Native Geranium  
 Vanilla Glycine  
 Cudweed  
 Common Raspwort  
 Scrambled Eggs  
 Swamp Raspwort  
 Small St John's Wort  
 Scaly Buttons  
 Grassland Wood Sorrel  
 Variable Plantain  
 Swamp Dock  
 A Dock  
 Cotton Fireweed  
 Smooth Solenogyne  
 Yellow Rush Lily  
 Fuzzy New Holland Daisy  
 Narrow-leaf New Holand Daisy  
 Tufted Bluebell  
 Annual Bluebell  
 A Bluebell

**Native Other**

*Carex inversa*  
*Cheilanthes sieberi*  
*Juncus australis*  
*Juncus filicaulis*  
*Lomandra bracteata*  
*Lomandra filiformis*  
*Lomandra multiflora*  
*Schoenus apogon*

Knob Sedge  
 Rock Fern  
 A Rush  
 A Rush  
 Short-flowered Mat-rush  
 Wattle Mat-rush  
 Many-flowered Mat Rush  
 Common Bog Sedge

**Exotic Flora**

*Acetosella vulgaris*  
*Aira sp.*  
*Avena fatua*  
*Briza maxima*  
*Briza minor*  
*Bromus hordeaceus*  
*Bromus catharticus*  
*Carthamus lanatus*  
*Centaurium erythraea*  
*Chondrilla juncea*  
*Cirsium vulgare*  
*Conyza sp.*  
*Crataegus monogyna*  
*Cynodon dactylon*  
*Cyperus eragrostis*  
*Dactylis glomerata*  
*Echium plantagineum*  
*Eleusine tristachya*

Sheep Sorrell  
 Hairgrass  
 Wild Oats  
 Quaking Grass  
 Shivery Grass  
 Brome Grass  
 Prairie Grass  
 Saffron Thistle  
 Pink Stars  
 Skeleton Weed  
 Spear Thistle  
 Fleabane  
 Hawthorn  
 Couch Grass  
 Umbrella Sedge  
 Cocksfoot  
 Patterson's Curse  
 Goose Grass

**Exotic Flora (continued)**

*Eragrostis curvula*

African Love Grass

**Scientific Name**

*Erodium sp.*  
*Festuca arundinacea*  
*Gamochaeta purpurea*  
*Hirschfeldia incana*  
*Holcus lanatus*  
*Hordeum leporinum*  
*Hypericum perforatum*  
*Hypochaeris radicata*  
*Leontodon taraxacoides*  
*Lepidium africanum*  
*Lolium perenne*  
*Malva parviflora*  
*Modiola caroliniana*  
*Nassella neesiana\**  
*Nassella tricotoma\**  
*Onopordum acanthium*  
*Orobanche minor*  
*Paspalum dilatatum*  
*Petrorhagia nanteuilli*  
*Phalaris aquatic*  
*Plantago lanceolata*  
*Poa trivialis*  
*Polygonum aviculare*  
*Pyracantha sp.*  
*Rosa rubiginosa*  
*Rubus fruticosus\**  
*Rumex crispus*  
*Salix sp.*  
*Sonchus oleraceus*  
*Tolpis barbata*  
*Tragopogon porrifolius*  
*Trifolium arvense*  
*Trifolium angustifolium*  
*Trifolium dubium*  
*Trifolium subterraneum*  
*Verbascum thapsus*  
*Verbascum virgatum*  
*Vulpia sp.*

**Common Name**

Herons Bill  
Tall Fescue  
A Cudweed  
Hoary Mustard  
Yorkshire Fog Grass  
Barley Grass  
St John's Wort  
Cats ears  
Lesser Hawkbit  
Common Peppergrass  
Rye Grass  
Small-flowered Mallow  
Carolina Mallow  
Chilean Needle Grass  
Serrated Tussock  
Scotch Thistle  
Common Boomrape  
Paspalum  
Proliferous Pink  
Phalaris  
Ribwort Plantain  
Rough Meadowgrass  
Wireweed  
Firethorn  
Sweet Briar  
Blackberry  
Curly Dock  
Willow  
Common Sow-thistle  
Yellow Hawkweed  
Salsify  
Hares Foot Clover  
Narrow-leaved Clover  
Yellow Suckling Clover  
Subterranean Clover  
Great Mullein  
Twiggy Mullein  
Fescue

\*Weed of National Significance

Source: PCS and Alison Rowell

## Appendix C: Fauna Species List

Scientific Name	Common Name
<b>Birds</b>	
<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill
<i>Accipiter cirrocephalus</i>	Collared Sparrowhawk
<i>Acridotheres tristis</i> *	Common Myna
<i>Acrocephalus australis</i>	Australian Reed-Warbler
<i>Alauda arvensis</i> *	Sky Lark
<i>Anas gracilis</i>	Gray Teal
<i>Anas superciliosa</i>	Pacific Black Duck
<i>Anthochaera carunculata</i>	Red Wattlebird
<i>Anthus novaeseelandiae</i>	Australasian Pipit
<i>Artamus cyanopterus</i>	Dusky Woodswallow
<i>Artamus superciliosus</i>	White-browed Woodswallow
<i>Aythya australis</i>	White-eyed Duck
<i>Cacatua galerita</i>	Sulphur-crested Cockatoo
<i>Carduelis carduelis</i> *	European Goldfinch
<i>Cincloramphus cruralis</i>	Brown Songlark
<i>Cincloramphus mathewsi</i>	Rufous Songlark
<i>Cisticola exilis</i>	Golden-headed Cisticola
<i>Coracina novaehollandiae</i>	Black-faced Cuckooshrike
<i>Corvus coronoides</i>	Australian Raven
<i>Coturnix ypsilophora</i>	Brown Quail
<i>Eolophus roseicapilla</i>	Galah
<i>Falco cenchroides</i>	Australian Kestrel
<i>Falco longipennis</i>	Australian Hobby
<i>Fulica atra</i>	Eurasian Coot
<i>Gallina cyanoleuca</i>	Magpie-lark
<i>Gymnorhina tibicen</i>	Australasian Magpie
<i>Hieraetus morphnoides</i>	Little Eagle
<i>Hirundo neoxena</i>	Welcome Swallow
<i>Lalage sueurii</i>	White-winged Triller
<i>Lichenostomus penicillatus</i>	White-plumed Honeyeater
<i>Malurus cyaneus</i>	Superb Fairywren
<i>Merops ornatus</i>	Rainbow Bee-eater
<i>Neochmia temporalis</i>	Red-browed Firetail
<i>Ocyphaps lophotes</i>	Crested Pigeon
<i>Passer domesticus</i> *	House Sparrow
<i>Petrochelidon ariel</i>	Fairy Martin
<i>Phalacrocorax carbo</i>	Great Cormorant
<i>Platycercus eximius</i>	Eastern Rosella
<i>Porphyrio porphyrio</i>	Purple Swamphen
<i>Psephotus haematonotus</i>	Red-rumped Parrot
<i>Rhipidura leucophrys</i>	Willie-wagtail
<i>Rostratula benghalensis</i>	Painted Snipe
<i>Stagonopleura guttata</i>	Diamond Firetail
<i>Sturnus vulgaris</i> *	European Starling
<i>Tachybaptus novaehollandiae</i>	Australasian Grebe

**Scientific Name***Vanellus miles***Invertebrates***Cooraboorama canberrae**Synemon plana***Mammals***Macropus giganteus**Vombatus ursinus***Amphibians***Crinia parinsignifera**Crinia signifera**Limnodynastes dumerilii**Limnodynastes peronii**Limnodynastes tasmaniensis***Common Name**

Masked Lapwing

Canberra Raspy Cricket

Golden Sun Moth

Eastern Grey Kangaroo

Wombat

Plains Froglet

Common Eastern Froglet

Banjo Frog or Pobblebonk

Striped Marsh Frog

Spotted Grass Frog

\* Exotic species

Sources:

Birds: Michael Kingsford, Alison Rowell and PCS

Invertebrates: PCS and Alison Rowell

Mammals: PCS and Alison Rowell

Frogs: Frogwatch 2012 census data

## Appendix D: 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 ≤ high
	Grass and open woodland	Grassland fuel hazard ≤ 50 when grassland curing ≥ 70%
	Identifies arterial roads, rural roads and easements	Grassland fuel hazard ≤ 35 when grassland curing ≥ 70%.

Source: ACT Government 2009

The current fuel management standard for Strategic Firefighting Advantage Zones in grassland and open woodland areas (as applicable to most of Jarramlee) is that for at least 70% of the grassland fuel hazard must be ≤ 50 when the grassland curing ≥ 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 (m)	Cover %									
	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 2009

### References:

ACT Government (2009) *Strategic Bushfire Management Plan for the ACT*. Emergency Services Agency, Canberra.

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