Lawson Offset Strategy

November 2013

Prepared by the Land Development Agency on behalf of the ACT Government

Contents

1. Introduction

This Offset Strategy has been developed to meet the requirements of the approval decision (EPBC2010/5549) for the Lawson Residential Estate (Block 2 Section 5 and Block 2 Section 13, Lawson) under the Australian *Environment Protection and Biodiversity Conservation Act 1999* (EPBC) Act. EPBC2010/5549 was approved on 13 September 2012 and required the development of an Offset Strategy to compensate for impacts to the Golden Sun Moth (GSM) and Natural Temperate Grassland (NTG) at Lawson. In accordance with Condition 12 of the approval decision, this Offset Strategy includes:

a) Administration arrangements to conserve, in perpetuity, the Macgregor West offset area
b) Provision of not less than $972,000 (GST exclusive) to facilitate management of the Macgregor West offset area
c) The process for incorporating the Macgregor West offset area within the ACT Nature Reserve System
d) Results of surveys undertaken by a suitably qualified expert at an optimal ecological time to demonstrate the extent of Golden Sun Moth habitat in the Macgregor West offset area
e) A map that defines the extent of the Natural Temperate Grassland and habitat for the Golden Sun Moth within the Macgregor West offset area as a result of Condition 12d).

This Offset Strategy builds on the information presented in the *South Lawson Biodiversity Offset Strategy*, prepared by SMEC in support of the EPBC2010/5549 referral, and which provided the foundation for the agreement of the West Macgregor site as the offset area for Lawson. The Offset Strategy is complemented by an Offset Management Plan (OMP), as required by Condition 13 of the approval decision, which details the management prescriptions for the offset site. The OMP is a separate, supporting document.

2. Location

The Macgregor West offset area, known as Jarramlee, is located on the north western boundary of the ACT in the district of Belconnen (refer Figure 1). The area is located within 200 metres of the suburbs of Dunlop and West Macgregor and is bounded by rural grazing land within the ACT (agisted and leased land) and NSW (freehold). The site is contiguous with the West Macgregor offset site under EPBC2010/5520 and is proximate to the Dunlop Grasslands Nature Reserve (1.1 kilometres to the north east) and Woodstock Nature Reserve (2.6 kilometres to the south west) (refer Figure 2).

Figure 1: Jarramlee Offset Area

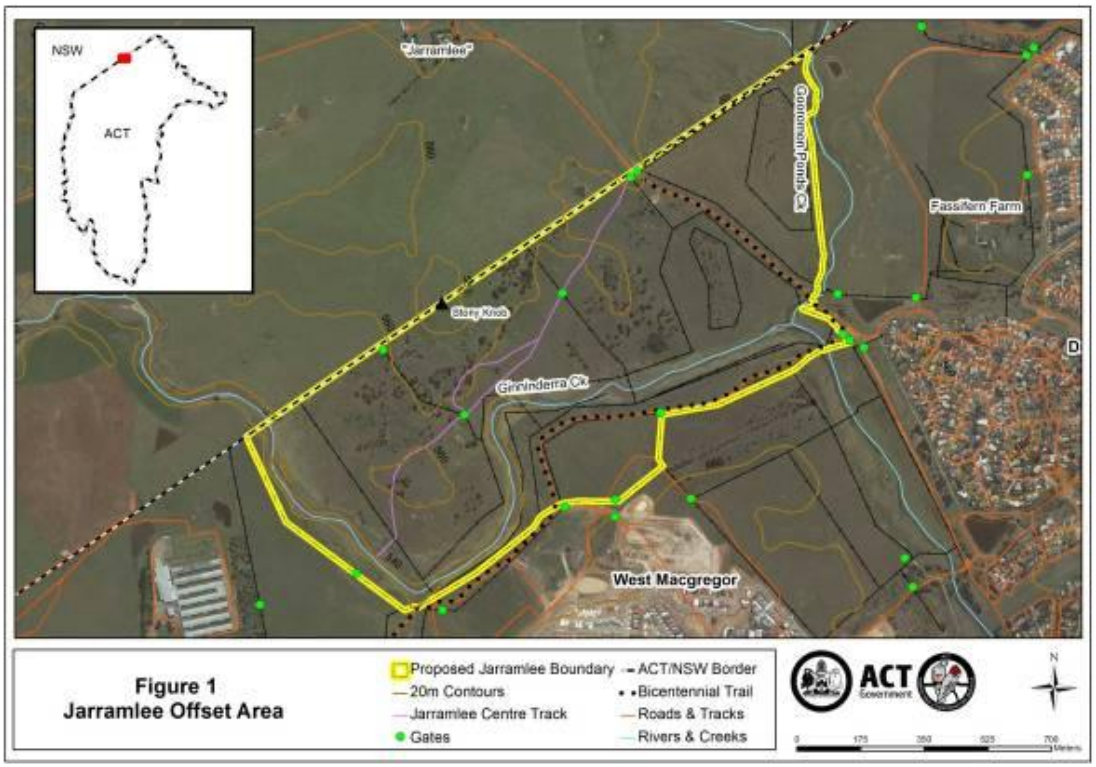
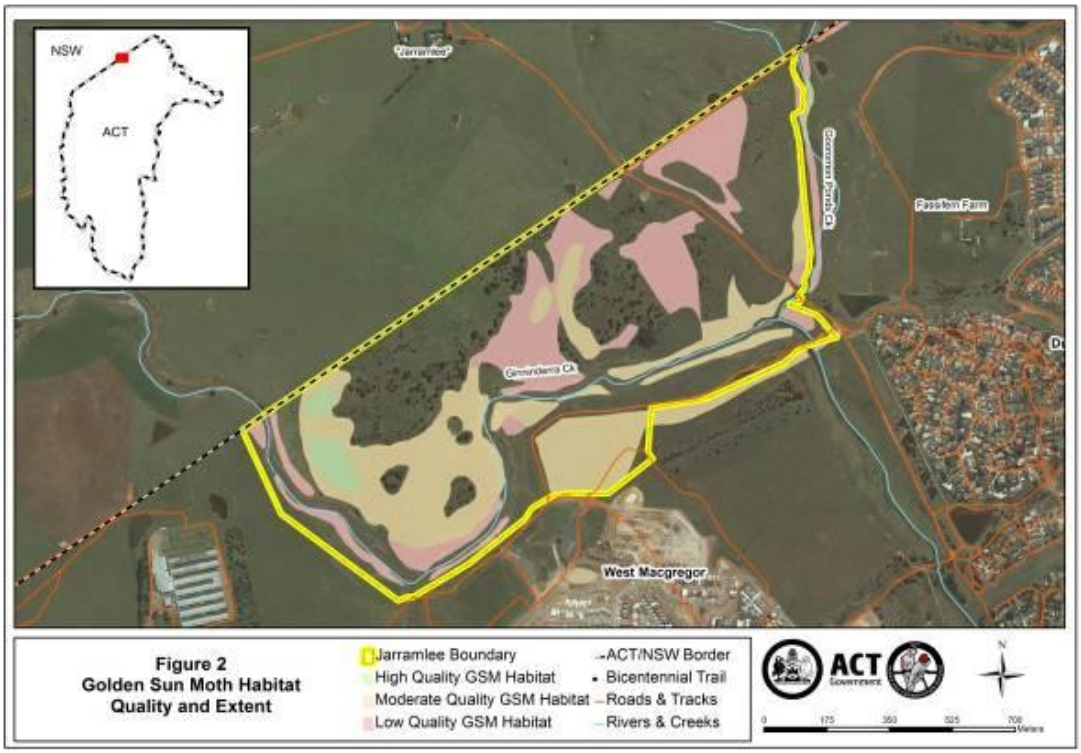


Figure 2: Golden Sun Moth Habitat Quality and Extent



3. Site Description

Jarramlee, West Macgregor is known as Blocks 1442 and 1620, Section O, part of Block 2, Section 186, part of Block 7, Section 149 and part of Block 1621, Section O.

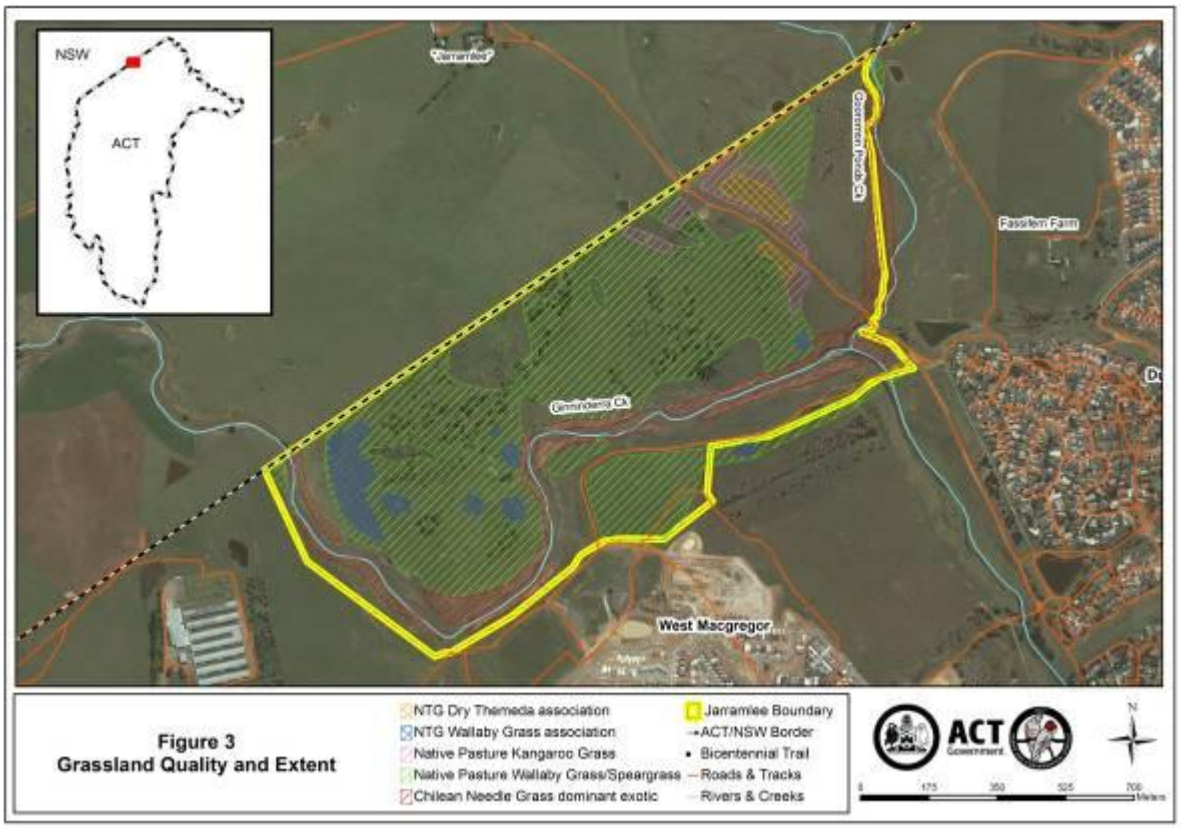
Jarramlee is approximately 112 hectares in area and is of high conservation significance, supporting habitat for GSM, NTG and habitat for woodland birds and locally threatened species of bird. Ginninderra Creek and Gooromon Ponds, which converge within Jarramlee, provide important habitat for local flora and fauna.

The habitat of Jarramlee was intensively surveyed during December 2012, January and February 2013 by Alison Rowell, a suitably qualified expert in GSM and NTG. *Surveys of Natural temperate Grassland and Golden Sun Moth at Lawson South Offset Area, Jarramlee/West Macgregor, December 2012 to February 2013* is included at Attachment 1.

In summary, the survey indicated that the vegetation is native dominated grassland (albeit weedy) with native pasture and NTG. The floodplain and the creek line of Ginninderra Drive are exotic-dominated, with some parts dominated by Chilean Needlegrass. Figure 3 illustrates the vegetation types across the site.

The survey indicates there are approximately five hectares of NTG and 48 hectares of GSM habitat on site.

Figure 3: Grassland Quality and Extent



4. Conservation

4.1 The Offset

The *South Lawson Biodiversity Offset Strategy*, prepared by SMEC in support of the EPBC2010/5549 referral, indicated the following targets for GSM and NTG:

Affected MNES	Area Impact (ha)	Agreed Ratio	Gross Target Offset (Direct-ha/Indirect-$)
GSM known habitat	32	3:1	96ha + $392,940
GSM potential habitat	16	2:1	$576,000
NTG	1.3	5:1	6.5ha

A direct offset target of 96 hectares of GSM habitat and 6.5 hectares of NTG was proposed at Jarramlee. To meet the overall offset target it was agreed that an investment of $968,940 (indirect offset) would be utilised to maintain or improve the habitat at Jarramlee.

A detailed survey of Jarramlee has revealed that the quantum of habitat is below the target offset in the EPBC referral. As stated in Section 3 there are approximately five hectares of NTG and 48 hectares of GSM habitat on site. It is contended that this quantum of habitat will still meet the intent of the offset target given the strategic location of Jarramlee and the opportunities to link fragmented populations through restoration works. This is discussed in detail below.

4.2 Conservation Benefits

The patches of NTG at Jarramlee are surrounded by lower quality native pasture, which provides the opportunity for rehabilitation and enhancement of the surrounding grassland under appropriate management (Rowell, 2013, p9). Experience in other grassland reserves in the ACT demonstrates that the size of NTG can increase with active restoration and favourable biomass and weed control management measures. Refer to the OMP for details on the proposed management practices to improve NTG at Jarramlee, and thus meet the 6.5 hectare offset target.

Whilst Jarramlee is nominated as the area of direct offset for impact on MNES at Lawson the investment funding will be utilised to improve connectivity between Jarramlee and nearby nature reserves through restoration works within Jarramlee and on adjacent public lands (refer to the OMP for details of management). Figure 2 illustrates the strategic location of Jarramlee between two existing nature reserves and adjacent to the nature reserve being established under EPBC2010/5520.

Jarramlee and the associated investment funding will enable the consolidation of one of the largest remaining GSM habitat areas in Australia. This consolidated habitat also supports one of the largest known populations in Australia.

One of the greatest threats to the long term viability of GSM is habitat fragmentation and isolation. The GSM National Recovery Plan (NSW Office of Environment and Heritage, 2012) supports the trialling of habitat enhancement measures, such as weed control and planting, to help link populations and improve their viability.

Of the 73 remaining sites within the ACT, only three provide a habitat area of greater than 100 hectares (Mulvaney, 2013). Currently the Macgregor West offset area (EPBC2010/5520) and Jarramlee form a continuous habitat area of around 96 hectares. Dunlop Grassland Reserve to the north-east of Jarramlee has a habitat area of around 86 hectares. The offset package allows for the enhancement and connection of these habitat areas to form a continuous area of habitat within the ACT of around 250 hectares. This consolidated habitat area would also be contiguous with three separate patches of habitat within NSW with an area of about 50 hectares. This would represent the third largest area of GSM habitat within the ACT Region, after Goorooyaroo-Mulligans Flat and the Majura Valley.

Across the 73 sites within the ACT, there are 11 sites that support very large populations. Maximum daily population counts for a site range from 1 moth to 5347 moths. The mean number is 155 and the median count is 13. Forty two sites (58%) have only small populations observed on them, 13 (18%) of sites have a moderate moth count and seven (10%) have recorded a large number of moths on at least one occasion.

The West Macgregor offset site (EPBC2010/5520) and Jarramlee together represent one of only two sites in the ACT where more than 1500 moths have been counted on a single day, which is considered to be a very large population size (Richter et al, 2009). Dunlop Grasslands Nature Reserve to the north east hosts a large population. These figures demonstrate the strategic importance of the Jarramlee site in supporting and improving the situation for GSMs in the ACT.

Whilst the Jarramlee site currently represents a shortfall in the quantum area of GSM habitat nominated as the offset target in the EPBC referral, its strategic context in connecting habitat cannot be underestimated. It will be possible to improve the quality of the existing habitat with weed control and appropriate biomass management as well as rehabilitate additional areas on site (and adjacent) to create and maintain movement corridors (Rowell, 2013, p10). Refer to the OMP for management practices to achieve this aim.

4.3 Administrative arrangements

Approximately 112 hectares of land at Jarramlee is to be included in the ACT Nature Reserve system (refer Figure 1). This will provide security of tenure and conserve the offset area in perpetuity.

A very small portion of Jarramlee is currently zoned PRZ1 Urban Open Space under the provisions of the Territory Plan. The majority of the site is zoned NUZ3 Hills, Ridges and Buffer Area. The NUZ3 zone objectives are:

- Conserve the environmental integrity of the hill system as a visual backdrop and a unified landscape setting for Canberra
- Provide opportunities for appropriate recreational uses
- Conserve the significant cultural and natural heritage resources and a diversity of natural habitats and wildlife corridors
- Provide predominantly open buffer spaces for the visual separation of towns and to provide residents with easy access to hills, ridges and buffer areas and associated recreation facilities
- Provide opportunities for appropriate environmental education and scientific research activities

This NUZ3 land use zone provides the relevant framework for the conservation of the offset area. The PRZ1 land use zone will be rezoned to NUZ3.

Jarramlee is unleased Territory land. To include the land into the Canberra Nature Park a variation to the Territory Plan is required (under Part 5.3 of the *Planning and Development Act 2007*) to include an overlay on the Territory Plan map that denotes it as 'Pc - a nature reserve'.

The variation will be commenced as soon as approval of this offset strategy is given. The process to vary the Territory Plan typically takes between six and 12 months, includes a public consultation period and requires Ministerial approval and presentation to the Legislative Assembly.

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

An amount of $972,000 will be provided to the ACT Territory and Municipal Services Directorate to manage the offset area and to help fund the restoration of the adjoining grasslands to improve connectivity between nature reserves. The OMP provides a works schedule detailing the expenditure of the funds (which is recreated on the next page for ease of reference).

5. Extract of Works Plan from the Jarramlee Offset Management Plan

5.1 Capital Improvements Works Plan

Proposed Activity[#]	Description of Proposed Works[#]	Responsibility	Estimated timeframe for completion	Estimated Budget[#]	Estimated On-going Operational Costs (p.a.)
Fencing	• Upgrade to "vandal resistant" gates along Bicentennial National Trail. • Repair or replacement other boundary fences as needed. • Fence off Ginninderra and /or Gooromon Ponds Creek as guided by the biomass management plan to protect stream banks from stock trampling. • 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.	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

5.2 Environmental Restoration and Research Plan

Activity	Description of Proposed Works	Responsibility	Estimated timeframe for completion	Estimated budget[#]	Estimated on-going operational costs (p.a.)[#]
Riparian Restoration	• Undertake stream bank protection works at the confluence of Ginninderra Creek and Gooromon Ponds Creek to protect golden sun moth habitat from erosion. • 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. • Seek advice from CPR on plant species selection and on the location of the revegetation works.	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	-

5.3 On-going Operational Works Plan

Proposed Activity	**Description of Proposed Works**	**Responsibility**	**Estimated timeframe for completion**	**Estimated budget[#]**	**Estimated on-going operational costs (p.a.)[#]**
Weed control	• 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. • 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. • 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. • To maintain an open grassland structure regenerating trees and shrubs should be removed from outside woodlots.	PCS	2013-14 2014-15 2015-16 2016-17	$30,000 $20,000 $15,000 $15,000	$15,000
Vertebrate pest control (Rabbits)	• Undertake a low risk control program. • Spotlight counts in spring and autumn. • Map active warrens in winter and control rabbits in spring. • Follow up control may be necessary.	PCS	2013-14 2014-15 2015-16 2016-17	$10,000 $5,000 $5,000 $5,000	$5,000

5.4 Monitoring Golden Sun Moth and Natural Temperate Grassland

Activity	Description	Responsibility	Timeframe	Estimated budget[#]	Estimated on-going operational costs (p.a.)[#]
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 4 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 5 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	-

5.5 Management Resources

Activity	Description	Responsibility	Timeframe	Estimated budget[#]	Estimated on-going operational costs (p.a.)[#]
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
			Total	**$972,000**	**$50,600**

References

Mulvaney, M, (2013) *Golden Sun Moth Draft Interim ACT Strategic Conservation Plan*. Prepared for the ACT Flora and Fauna Committee. Canberra

NSW office of Environment and Heritage (2012) *Draft National Recovery Plan for Golden Sun Moth Synemon plana.* Environment and Heritage (NSW), Hurstville

Richter, A., Osborne, W., Robertson, G. & Hnatiuk, S. (2009). Community Monitoring of Golden Sun Moths in the Australian Capital Territory Region, 2008-2009*,* University of Canberra, Canberra.

Rowell, A. (2013) Surveys of Natural temperate grassland and Golden Sun Moth at Lawson South Offset Area, Jarramlee/West Macgregor December 2012 to February 2013. Prepared for the ACT Land Development Agency, Canberra.

Attachment 1

Surveys of Natural Temperate Grassland and Golden Sun Moth at Lawson South Offset area, Jarramlee/West Macgregor December 2012 to February 2013

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Contents

Surveys of Natural Temperate Grassland and Golden Sun Moth at Lawson South Offset area, Jarramlee/West Macgregor

December 2012 to February 2013

1. Background

The Land Development Agency has received approval from the Department of Sustainability, Environment, Water, Population and Communities for a residential development at Lawson South, subject to a number of conditions designed to protect a listed threatened species and threatened community (Golden Sun Moth and Natural Temperate Grassland). This is to be achieved by managing the species and community on part of the site, and by developing and implementing an Offset Strategy and Offset Management Plan at a site in West Macgregor.

The conditions for the Offset area addressed by this report are:

- Condition 12 (d). (Offset Strategy is to include) results of surveys undertaken by a suitably qualified expert at an optimal ecological time to demonstrate the extent of Golden Sun Moth habitat in the Macgregor West Offset area
- Condition 12 (e). (Offset Strategy to include) a map that defines the extent of Natural Temperate Grassland and habitat for the Golden Sun Moth within the Macgregor West Offset area as a result of Condition 12 (d).

2. The Offset site

The site occupies a low ridge roughly bounded by Ginninderra Creek and its floodplain to the west, south and east, and by the ACT/NSW border to the north. It lies just outside the estimated pre-settlement boundary of natural grassland and contains eucalypt plantings, but no naturally-occurring trees and no stumps or logs that would indicate recent clearance of woodland.

The site has been identified as containing Natural Temperate Grassland (NTG), as well as habitat occupied by the Golden Sun Moth (GSM) (ACT Government 2005, Biosis 2010).

2.1 Natural Temperate Grassland

Natural Temperate Grassland of the Southern Tablelands of NSW and the Australian Capital Territory is listed as an endangered community under the Commonwealth Environment *Protection and Biodiversity Conservation Act 1999 (EPBC Act*) and the *ACT Nature Conservation Act 1980 (NC Act*). In the National Recovery Plan (Environment ACT 2005) the endangered community is defined as follows:

'Natural Temperate Grassland is a native ecological community that is dominated by native species of perennial tussock grasses. The dominant grasses are *Themeda triandra, Austrodanthonia* species, *Austrostipa* species, *Bothriochloa macra* and *Poa* species.

The upper canopy stratum generally varies in height from mid-high (0.25-0.5 m) to tall (0.5-1.0 m). There is also a diversity of native herbaceous plants (forbs), which may comprise up to 70% of species present. The community is naturally treeless or has less than 10% projective foliage cover of trees or shrubs in its tallest stratum.'

2.2 Golden Sun Moth

The Golden Sun Moth *Synemon plana* is listed as a critically endangered species under the *EPBC Act* and as endangered under the *NC Act*. A critically endangered species is considered to be facing an extremely high risk of extinction in the wild in the immediate future.

The current understanding (various authors in DEWHA 2009) is that GSM occurs in primary or secondary native grassland, or clearings in open woodland, especially habitats containing a moderate component of Wallaby Grasses. Wallaby Grasses were until recently known as *Austrodanthonia*, but have been renamed *Rytidosperma*. *Austrodanthonia* will be used in this report due to the long association of this name with GSM habitat in the literature. GSM has also been found in association with other native grasses, and the exotic Chilean Needlegrass *Nassella neesiana*. The larvae feed on the roots of the grasses, and recent dietary studies have confirmed that the larvae feed on plants that use the C3 carbon-fixing metabolic pathway, and that the C3 plants found on GSM sites are predominantly Speargrasses *Austrostipa* species, Wallaby Grasses and Chilean Needlegrass (Richter et al 2010). Sites are usually flat or gently sloping, with northerly aspects favoured. Sites are generally low in phosphorus (unimproved) and have bare ground between the tussocks. High biomass appears to make the habitat less suitable, as females use bare ground to bask and display, and males tend to search for females in areas of relatively low open grassland.

3. Methods

3.1 Natural Temperate Grassland

Grassland surveys are ideally undertaken in mid to late spring, when most of the variety of species that make up the community are detectable. The current survey was commissioned in late December after a fairly dry spring. The western part of the site was being grazed by a small number of cattle, and most of the eastern part was covered in tall dense grasses which may have been suppressing or concealing some smaller plant species. Due to these constraints, the boundaries of the threatened community would benefit from refinement by spring surveys, but areas in doubt were included rather than excluded i.e. the mapping of NTG should represent the maximum extent of the community on the site.

The site was intensively surveyed on foot on 19 and 21 December 2012, 14/15 and 24 January, and 9 February 2013. The ground layer vegetation mapped using aerial photomaps and a handheld GPS. Vegetation was categorized in the following way:

- **Exotic-dominated vegetation**, where greater than 50% of the perennial vegetation cover was exotic, and native species were mostly disturbance-tolerant grasses. A subset of this category was:
    - *Exotic-dominated vegetation* with a high component of *Chilean Needlegrass* (GSM larval food plant).
- **Native-dominated vegetation**, where greater than 50% of the perennial vegetation cover was native. This category was subdivided as follows:
    - *Native pasture*, where weed cover was moderate to high, and native species diversity was low and restricted to disturbance-tolerant species
    - *Natural Temperate Grassland*, where weed cover was low to moderate and moderate numbers of forb species were present, including some less disturbance-tolerant species (Rehwinkel 2007). NTG was further divided into the following floristic associations (ACT Government 2005):
        - *Austrodanthonia* grassland, where the dominant species are Wallaby Grasses, Speargrasses Austrostipa spp. and Redleg Grass *Bothriochloa macra*. This floristic association is typical of GSM habitat.
        - Dry Themeda grassland, where the dominant grasses are Kangaroo Grass *Themeda triandra*, Speargrasses, Tussock Grass *Poa sieberiana* and Wallaby Grasses. This association is less typical of GSM habitat, especially where the C4 Kangaroo Grass forms dense stands.

3.2 Golden Sun Moth

3.2.1 GSM activity

Surveys for GSM are undertaken during the spring and summer, when adults emerge from their pupal cases in the soil to mate and lay eggs. The flying season began in the first week of November 2012 and ended in the first week of January 2013, with peak flying events occurring on hot days in the first three weeks of December.

There were only two days of survey on the site that fell within the activity period of GSM in the ACT in 2012-2013. Almost the whole potential habitat area was covered by walked transects 50 to 100 metres apart on those days, under weather conditions suitable for detecting GSM. Habitat areas with moderate amounts of bare ground were searched for pupal cases in December and January, as this is an additional way of detecting the species just after the flying period (Richter *et al.*, 2012). GSM were recorded several times at an adjacent site on the Ginninderra Creek flats in the 2012 season, including one week before and two weeks after our surveys (Bill Sea, University of Canberra, pers. comm.).

3.2.2 GSM habitat

Potential habitat was mapped during GSM and vegetation surveys, and was identified as treeless areas where the perennial ground layer was dominated by native grasses or Chilean Needlegrass. By this definition potential habitat may contain a moderate component of annual or perennial weeds or pasture species.

Sites dominated by Chilean Needlegrass can support dense GSM populations at times (Braby & Dunford 2006). Such areas on this site were classified as moderate quality habitat only, due to the potential for extreme fluctuations in biomass on the exotic-dominated creek flats, which is likely to be detrimental to GSM emergence and mating.

Some higher quality grassland was observed around rock outcrops. This was not considered to be high quality GSM habitat, as this condition appears to be a result of shallow rocky soils favouring native plants over exotics, but such areas are not associated with high densities of GSM, probably due to low root volume of grasses on such soils.

Very dense patches of Kangaroo Grass were also not considered to be high quality GSM habitat, as GSM is not strongly associated with this C4 species. C3 grasses such as Wallaby Grasses and Speargrasses were scattered through less dense patches of Kangaroo Grass, and GSM is sometimes observed in such vegetation.

The different levels of habitat quality on the site were defined by some or all of the following characteristics:

Low quality potential habitat:

- dominated by Kangaroo Grass with a few C3 native grasses
- significant pasture improvement (Phalaris, Subterranean Clover, Ryegrass) but containing a moderate amount of Chilean Needlegrass
- moderate component of other exotic species
- little bare ground between the tussocks, due to dense grass growth and/or a dense litter layer

Moderate quality potential habitat:

- patches dominated by native grasses, including some Kangaroo Grass
- patches dominated by Chilean Needlegrass
- low to moderate weed cover
- some bare ground between the tussocks
- minor evidence of pasture improvement
- higher quality grassland around rock outcrops

High quality potential habitat:

- dominated by native grasses, including a moderate component of Wallaby Grasses (but not on rock outcrops or dominated by Kangaroo Grass)
- a diversity of native forbs indicating low levels of past disturbance
- low cover of weeds
- moderate amount of bare ground.

4. Results

4.1 Vegetation summary

The main vegetation type in the Jarramlee paddock is more or less weedy but native-dominated grassland (native pasture and NTG), mainly derived from the *Austrodanthonia* floristic association. This paddock contains several patches of planted eucalypts which appear to be about 30 years old, and woody weeds are scattered across the site. There is little tree regeneration, and many are species that would not naturally occur in this district or in this part of the landscape. The understorey of most of the plantations is weedy but still dominated by native grasses. The Ginninderra Creek flats are exotic-dominated, as are some drainage lines in this paddock. The central hill is also exotic-dominated, possibly due to long-term use as a stock camp. The western end of this paddock (including outside the main fence east of the north-south section of the creek) contains a greater diversity of native species.

The eastern end of the Jarramlee paddock contains patches of Kangaroo Grass (derived from Dry *Themeda* floristic association), which extend to the east into paddocks on both sides of the Jarramlee access road.

The paddocks east of the Jarramlee road also contain a mixture of exotic and native-dominated grassland, with patches of planted eucalypts.

The paddock west of Jarramlee road and south of Ginninderra Creek contains native-dominated grassland derived from the *Austrodanthonia* floristic association.

The Ginninderra Creek flats are exotic-dominated, with some parts were dominated by Chilean Needlegrass and other sections containing dense stands of Phalaris with patches of Chilean Needlegrass. At the time of survey the vegetation was mostly ungrazed, tall and dense. This contrasted with a grazed section just south of the Gooromon Ponds junction, where considerable GSM activity was observed in 2012.

The vegetation types described above are shown in Figure 1. Lists were made of the plant species occurring in the higher quality areas of grassland and in GSM habitat on the Ginninderra Creek flats (Appendix 1).

4.2 Natural Temperate Grassland

NTG was found to be less extensive than indicated in earlier mapping (ACT Government 2005). This is probably due to the broadscale nature of the previous mapping rather than a decline in quality of the grassland. Some NTG patches east and west of the main paddock fence appear to have had lower levels of grazing and pasture improvement in the past, and there were also some diverse patches associated with rock outcrops in the western part of the paddock.

Twenty seven species of native forbs were recorded in NTG in the *Austrodanthonia* floristic association and twenty two in *the Dry Themeda* association, including some species associated with lower levels of past disturbance (Rehwinkel 2007). A spring survey would be likely to detect more of these sensitive species.

The patches of NTG are surrounded by lower quality native pasture, which provides the opportunity for rehabilitation and enhancement of the surrounding grassland under appropriate management.

4.3 Golden Sun Moth habitat

GSM habitat was identified over much of the site, excluding only the tree plantations and those exotic-dominated areas without a significant component of Chilean Needlegrass (Figure 2). Most of the Chilean Needlegrass patches were tall and dense, which reduces their suitability as GSM habitat, but this condition is partly due to recent wet years and can be modified by appropriate grazing in future. Areas dominated by Kangaroo Grass are not good GSM habitat, but they contained some patches of C3 grasses which are likely to increase in drier years or under occasional grazing.

No GSM or pupal cases (indicating larval development sites) were observed during the December surveys, despite records of GSM flying nearby in the same week. However, brief surveys in the 2009 season found low numbers in the main paddocks east and west of the Jarramlee road, and higher numbers along the Ginninderra Creek flats and the part of the equestrian trail south of the creek (Biosis 2010). 2009 was an unusually good year for GSM in the ACT, when they were found in moderate to high numbers and at several new sites (Hogg 2010).

The *EPBC* and ACT GSM survey guidelines (DEWHA 2009, CPR 2010) specify a minimum of four surveys during the peak flying season, so the timing and duration of the current surveys was insufficient to determine presence of the species. Given the recent (2009) records over most of the site, and the current and past records on the adjacent West Macgregor site (Bill Sea, University of Canberra pers. comm. 2013, Braby 2005), it should be assumed that all potential habitat on the Offset site is occupied by GSM, at least at low densities. The extent and density of the GSM population on the site will need to be determined by appropriately timed surveys in a future season.

It will be possible to improve the quality of the existing GSM habitat with weed control and appropriate biomass management. There is also an opportunity to manage and rehabilitate parts of the equestrian trail and the Ginninderra Creek floodplain to create and maintain movement corridors for GSM between areas of existing habitat on the Offset site, West Macgregor and Dunlop. This could be done by a combination of weed control and planting of C3 native grasses, and biomass management in existing dense patches of Chilean Needlegrass, which should be contained within their existing footprint.

4.4 Other environmental values

The tree plantations are not regenerating or causing significant shading of higher quality areas of grassland, and they provide shade for stock. They provide significant feeding and minor breeding habitat for a wide array of woodland birds, as well as a bird movement corridor in a substantially cleared/treeless area. For this reason it is suggested that the plantations be retained, but not extended or enhanced. Tree regeneration will probably be suppressed by occasional grazing by cattle, which is likely to be part of future management.

Bird species observed included species listed as vulnerable in the ACT and/or NSW (Little Eagle, Diamond Firetail). There is an apparently derelict nest in the west of the Jarramlee paddock which may have been used in the past by Little Eagles. Many birds were feeding young, including Dusky and White-browed Woodswallows, Diamond Firetails, and Rainbow Bee-eaters (a migratory species which probably nests in the exposed banks of Ginninderra Creek).

There was an active wombat burrow in the western part of the Jarramlee paddock, and evidence of wombats across the paddock. Eastern Grey Kangaroos were moderately common.

Several active burrows of the Canberra Raspy Cricket *Cooraboorama canberrae* were seen in the north-western part of the Jarramlee paddock. This uncommon and localized species is large and flightless, and usually associated with grasslands in moderate to good condition. Its burrows are known to be used for shelter by the endangered Grassland Earless Dragon on several sites in the ACT.

5. Appendix

South Lawson Offset Plan

Species list, 2012-13

Abundance:
C = common
O = occasional

R = rare

Weeds of National Significance
Indicator species, level 2 (Rehwinkel 2007)

Native Grasses

Scientific Name	Common Name	NTG Austrostipa	NTG Dry Themeda	Native Pasture	Ginninderra Creek flats
Aristida ramose	Wiregrass	O	.	R	
Austrodanthonia caespitose	Ringed Wallaby Grass			C	
Austrodanthonia carphoides	Short Wallaby Grass	O		R	
Austrodanthonia eriantha	Hill Wallaby Grass	C		C	
Austrodanthonia leevis	Smooth Wallaby Grass	O			
Austrodanthonia penicillata	Slender Wallaby Grass				
Austrodanthonia pilosa var. pilosa	Velvet Wallaby Grass	R			
Austrodanthonia sp.	Wallaby Grasses				R
Austrostipa bigeniculata	Tall Spear Grass	C	R	C	R
Austrostipa scabra	Rough Speargrass	O		O	R
Bothriochloa macra	Redleg Grass	O	O	O	
Chloris truncate	Windmill Grass			R	
Dichelachne crinite	Longhair Plumegrass	R		R	
Dichelachne sieberiana	A Plumegrass	R			
Dichelachne sp.	A Plumegrass		R		
Elymus scaber	Wheatgrass	O	O	O	
Eragrostis benthamii	A Lovegrass		R	R	
Panicum effusum	Hairy Panic Grass		R	R	
Poa labillardierei	Tussock Grass		R	R	
Poa sieberiana	Snowgrass	R		R	
Sorghum leiocladum	Wild Sorghum			R	
Themeda tiandra	Kangaroo Grass	O	C	R	

Native Forbs

Scientific Name	Common Name	NTG Austrostipa	NTG Dry Themeda	Native Pasture	Ginninderra Creek flats
Acaena sp.	Sheep's Burr	O	R	R	
Asperula conferta	Common Woodruff	R	R	R	
Carex inversa	Knob Sedge	O		O	
Chamaesyce drummondii	Caustic Weed				
Chenopodium pumilio	Crumbweed			R	
Cheilanthes sieberi	Rock Fern	R			
Chrysocephalum apiculatum	Yellow Buttons	C	O		
Chrysocephalum semipapposum	Clustered Everlasting		R	R	
Convolvulus angustissimus	Australian Bindweed	O		R	
Cymbonotus lawsonianus	Bears Ears	R			
Desmodium varians	Slender Tick Trefoil	O			
Dichondra repens	Kidney Weed	R	R		
Dichopogon fimbriatus	Nodding Chocolate Lily		R		
Einadia nutans	Climbing Saltbush			R	
Epilobium billardierianum	A Willow Herb	R	R	R	
Eryngium rostratum	Blue Devil	O			

Scientific Name	Common Name	NTG Austrostipa	NTG Dry Themeda	Native Pasture	Ginninderra Creek flats
Euchiton sphaericus	Star Cudweed	O	R	O	
Glycine tabacina	Vanilla Glycine	R			
Goodenia pinnatifida	Scrambled Eggs		R		
Hypericum gramineum	Small St John's Wort		R		
Juncus australis	A Rush		O	R	R
Juncus ?filicaulis	A Rush		R		
Leptorhynchos squamatus	Hairy Buttons	O	O		
Lomandra bracteata	A Mat-rush	O	O		
Lomandra filiformis	Wattle Mat-rush	R	R		
Lomandra multiflora	Many-flowered Mat-rush	R	R	R	
Plantago varia	Variable Plantain	O			
Rumex brownii	Swamp Dock	R	R	R	
Rumex dumosus	A Dock	R	R		
Schoenus apogon	Common-bog Rush		O		
Senecio quadridentalus	Cotton Fireweed			R	
Solenogyne dominii	Smooth Solenogyne	R			
Tricoryne elatior	Yellow Rush Lily	R	o	R	
Vittadinia muelleri	Fuzzyweed	O	o		
Wahlenbergia communis	Tufted Bluebell	o	o	R	
Wahlenbergia gracilenta	Annual Bluebell	R			
Wahlenbergia luteola	A Bluebell	o	O		

Native Shrubs and Trees

Scientific Name	Common Name	NTG Austrostipa	NTG Dry Themeda	Native Pasture	Ginninderra Creek flats
Acacia dealbata	Silver Wattle	R			
Acacia rubida	Red-Stemmed Wattle		R		
Cassinia quinquefaraia	Cassina	R			

Exotic Grasses

Scientific Name	Common Name	NTG Austrostipa	NTG Dry Themeda	Native Pasture	Ginninderra Creek flats
Aira sp.	A Hairgrass		R	O	
Avena sp.	Wild Oats			O	O
Briza maxima	Blowfly Grass			R	
Briza minor	Shivery Grass			O	
Bromus hordeaceus	A Brome Grass		O	C	
Bromus catharticus	Prairie Grass			O	C
Cynodon dactylon	Couch Grass			R	O
Dactylis glomerata	Cocksfoot				O
Eleusine tristachya	Goose Grass			R	R
Eragrostis curvula	African Lovegrass			R	
Festuca arundinaceae	Tall Fescue			O	
Holcus lanatus	Yorkshire Fog			O	C
Hordeum leporinum	Barley Grass			R	
Lolium perenne	Perennial Ryegrass			O	
Nassella neesiana	Chilean Needlegrass			O	C
Nassella trichotoma	Serrated Tussock	R		O	
Paspalum dialatum	Paspalum			R	O
Poe trivialis	Rough Meadowgrass				C
Phalaris aquatica	Phalaris		R	C	C
Vulpia sp.	Rat's-tail Fescue	O	O	C	O

Exotic Forbs

Scientific Name	Common Name	NTG Austrostipa	NTG Dry Themeda	Native Pasture	Ginninderra Creek flats
Acetosella vulgaris	Sorrell		O	C	
Carthamus lanatus	Saffron Thistle			O	
Centaurium erythaea	Pink Stars		O	O	
Chondrilla juncea	Skeleton Weed			R	
Cirisium valgare	Spear Thistle			R	R
Conyza sp.	A Fleabane			O	O
Cyperus eragrostis	Umbrella Sedge				R
Echium plantagineum	Paterson's Curse			O	
Erodium sp.	Heron's Bill			R	
Gamochaeta purpurea	A Cudweed			R	
Hirscfeldia incana	Hoary Mustard			O	
Hypericum perforatum	St John's Wort		O	C	O
Hypochaeris radicata	Catsear		O	O	
Lepidium arfricanum	Common Peppercress			R	
Malva parviflora	Small-flowered Mallow			R	R
Modiolo caronliniana	Scarlet Pimpernel			R	
Onopordum acanthium	Scotch Thistle			R	
Orobanche minor	Common Broomrape			R	
Petrorhagia nanteuilii	Proliferous Pink			R	
Plantago lanceolata	Ribwort Plantain		O	C	O
Polygonum aviculare	Wireweed				O
Rumex crispus	Curly Dock				R
Sonchus oleaceus	Common Sow-thistle			R	
Tolpis barbata	Yellow Hawkweed			R	
Trifolium angustifolium	Narrow-leaved Clover			R	
Trifolium arvense	Haresfoot Clover			O	
Trifolium subterraneum	Subterranean Clover			O	O
Verbascum thapsus	Great Mullein			R	
Verbascum virgatum	Twiggy Mullein			R	

Exotic Shrubs and Trees

Scientific Name	Common Name	NTG Austrostipa	NTG Dry Themeda	Native Pasture	Ginninderra Creek flats
Crataegus monogyna	Hawthorn			R	
Pyracantha sp.	Firethorn			R	
Rosa rubiginosa	Sweetbriar	O		O	
Rubus fruticosus	Blackberry			O	

Figure 1: Vegetation types at South Lawson offset area (Jarramlee / West Macgregor)

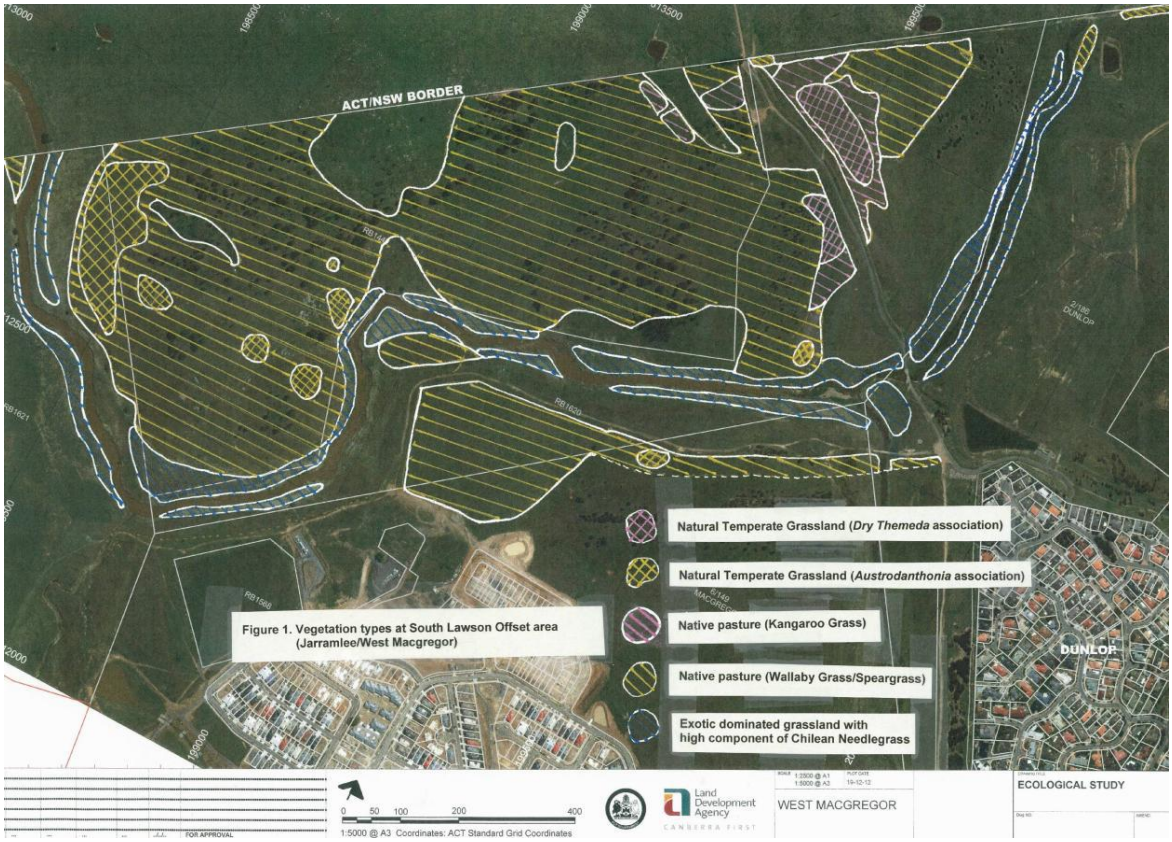
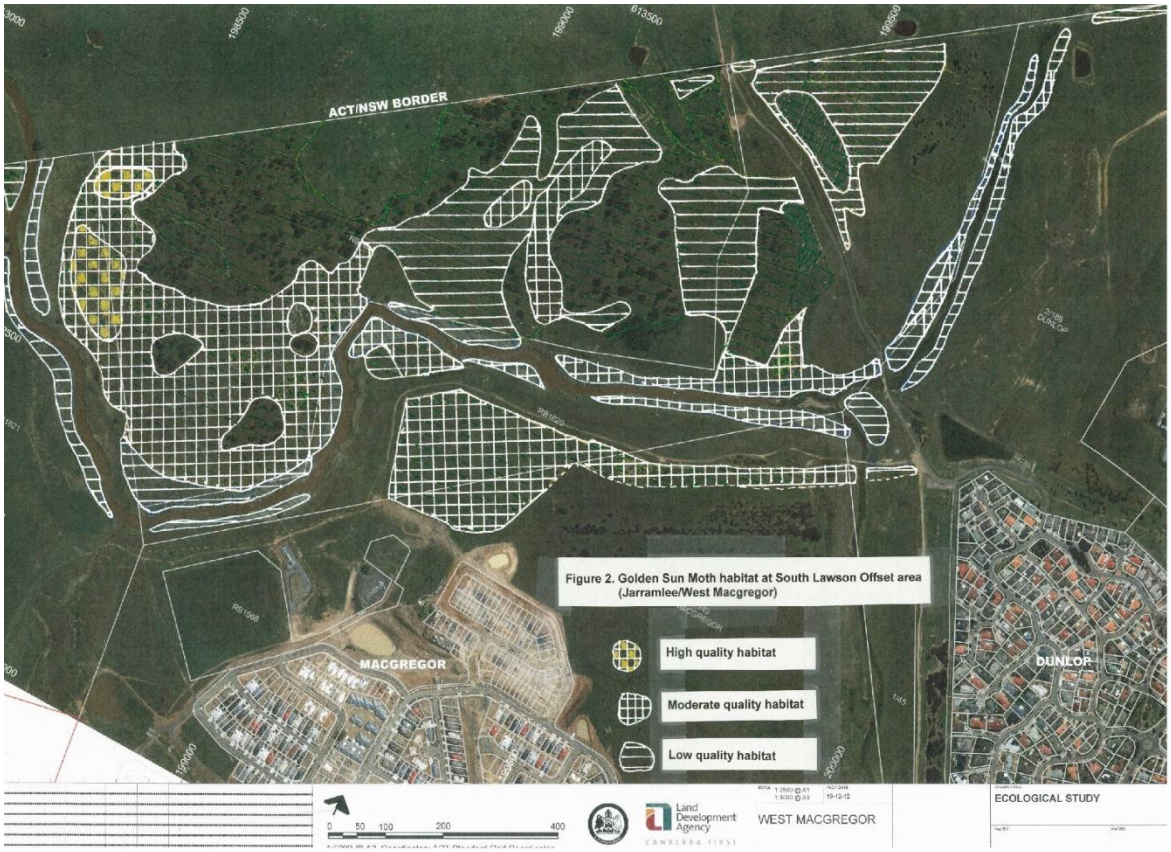


Figure 2: Golden Sun Moth habitat at south Lawson offset area (Jarramlee / West Macgregor)



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