

# **Riverview Project: Ginninderra Drive Extension Golden Sun Moth and Ecological Surveys**



*Blue Devil in flower*

**Report to Umwelt (Australia) Pty Ltd**

**by**

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# Riverview Project: Ginninderra Drive Extension Golden Sun Moth and Ecological Surveys

## 1. Background

The proposed extension of Ginninderra Drive as part of the final stages of the Riverview urban development project will result in ecological impacts in the vicinity of the Ginninderra Creek and Gooromon Ponds Creek confluence.

### 1.1 Project Area 1

In the Ginninderra Drive Extension area, two biodiversity offsets have previously been established pursuant to approvals under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). The West Macgregor Offset is 37 hectares, and relates to development of the West Macgregor urban area. The Jarramlee Offset is 112 hectares, and is associated with the development of Lawson South. Both offsets were established to provide compensation for the loss of golden sun moth habitat, however other ecological values are also present in both offset areas.

### 1.2 Project Area 2

Additional offset areas are considered potentially necessary to account for impacts to the already established offset areas described above, and three candidate sites have been identified along the NSW-ACT border. These are NSW Lot 1 (107 ha) and Lot 2 (86 ha) in DP 1144979 and ACT Block 48 Hall (58 ha) on Wallaroo Road.

## 2. 2014-15 Golden Sun Moth season

### 2.1 Golden Sun Moth activity

As in previous years, an informal email group was set up in 2014 to allow information on GSM activity to be shared among local consultants, researchers and government workers; references to concurrent GSM activity at other sites are taken from that source unless otherwise indicated.

Following good autumn rains, the winter/early spring period in the ACT in 2014 was quite dry. Some rain fell in October, and the average maximum for the month was above the long-term average. Flying male GSM were first reported at one ACT site on 4 November, and by 14 November there were reports of good numbers flying at many different sites. After heavy rain in mid-November the rest of the month was dry and warm, and flying recommenced. December was very wet, with 11 days receiving more than one millimetre of rain, causing many interruptions to the flying season and to surveys. There was a two day warm break in early January between two weeks of heavy rain, and GSM flew on both dry days, indicating that not all mature larvae had been able to pupate and fly in December.

## 2.2 Grassland vegetation condition

The sequence of weather conditions described above led to an extensive cover of Subterranean Clover on some sites in spring/summer 2014, and stronger than usual growth of Wild Oats and other smaller annual grasses at many sites. This meant that some sites were very different in appearance in 2014 than in drier years, with native vegetation smothered by dense patches of oats and clover.

It is not known what effect this type of vegetation change has on GSM larval development, but the larvae are likely to be disadvantaged by the suppression of the native grasses they feed on. Female GSM are also less likely to be able to successfully emerge, bask and display to attract males in dense exotic-dominated vegetation, and male GSM tend not to fly over tall vegetation when searching for females. Sites in this condition are likely to have less successful GSM flying, mating and egg-laying seasons than less degraded sites, probably leading to a decline in the GSM population.

## 3. Survey methods

Surveys followed the national guidelines for Golden Sun Moth surveys (DEWHA 2009) with some minor variations which are described in the sections dealing with each site.

Known reference sites were monitored from late October to determine the start of the season, and surveys began once flying was established at a number of sites. Habitat at each site likely to support GSM was identified and surveyed. This included native dominated grassland, derived grassland and open woodland containing Wallaby and Speargrasses, and areas dominated by Chilean Needlegrass (all larval food plants).

Surveys were undertaken in conditions as close to those recommended as possible, i.e.

- Warm to hot day (above 20°C by 1000 hrs)
- warmest part the day (i.e. 1000 – 1400 hrs)
- clear or mostly cloudless sky
- still or relatively still wind conditions during the survey period, and
- at least two days since rain.

Sites were visited at least four times. Surveys of flying males were supplemented by searches for egg-laying females after the daily flying period, and for pupal cases on days later in the season or when conditions were not ideal for surveying flying males. These additional searches were undertaken in areas that appeared to be good habitat, and/or where male moths had been recorded. Each pupal case search took about 3 minutes, with 4 to 10 square metres searched, depending on the density of the vegetation.

Transect surveys for flying males were undertaken. On sites where there was a large amount of continuous habitat, fixed parallel transects were sometimes used. On sites where the habitat was fragmented or few males were flying, meandering transects were used to maximise the coverage of potential habitat.

Other relevant information was collected, including the abundance of suitable larval food plants, vegetation structure, composition and condition, weed cover and the effect on habitat of current management.

## 4. Results

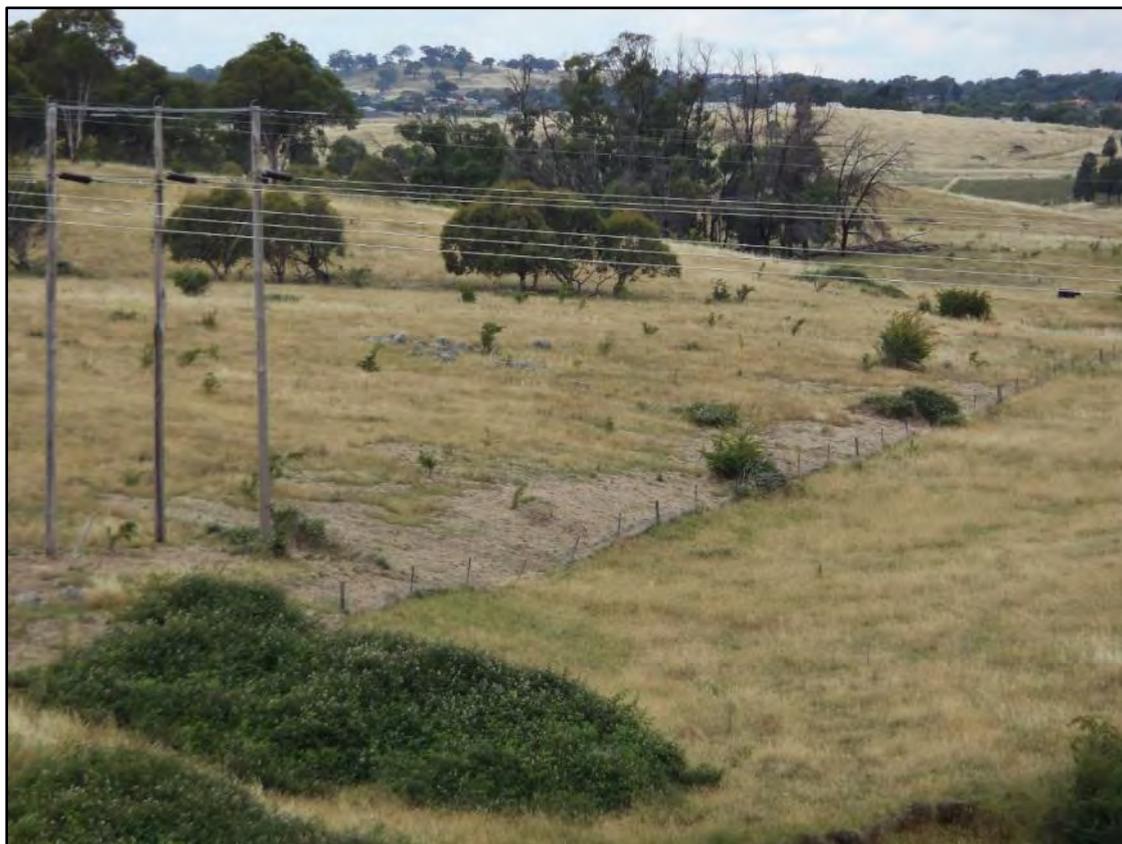
### 4.1 Jarramlee Nature Reserve

#### 4.1.1 Vegetation and habitat condition

The vegetation types and extent were very similar to the mapping in the Jarramlee Offset Management Plan (TAMS 2013). The vegetation on the Ginninderra and Gooromon Ponds creek flats was exotic dominated, with varying densities of Chilean Needlegrass. The higher parts of the site contained Wallaby Grass/Speargrass native pasture (very low diversity native grassland), with patches of Natural Temperate Grassland community (dry Themeda association) at the western end of the site and just east and west of the road to Jarramlee homestead. The paddock south of the central portion of Ginninderra Creek also contained very weedy native pasture. Some sensitive species such as Chocolate Lilies and Blue Devils were flowering in the eastern and western patches of Natural Temperate Grassland.

Woody weeds such as Blackberry, Sweetbriar and Hawthorn are still common in the central and western parts of the site. In 2014 there were patches of St Johns Wort and a dense growth of Wild Oats across most of the native pasture areas. Other exotic grasses such as Phalaris, Paspalum, Yorkshire Fog and Tall Fescue are growing with Chilean Needlegrass on the creek flats. Above the creek flats, patches of Chilean Needlegrass have been sprayed with herbicide (see photograph).

About 50 cattle were grazing the site during the surveys. Internal fences and gates have been installed or upgraded to manage stock, and the grassland was not as tall and dense as it was in autumn 2013. Small numbers of Eastern Grey Kangaroos were present on the site, and rabbits were seen around some blackberry patches.



Jarramlee showing woody weeds, Ginninderra Creek flats dominated by Chilean

Needlegrass (lower right) and sprayed Chilean Needlegrass in native pasture above the creek.

#### 4.1.2 Golden Sun Moth observations

Jarramlee was surveyed in sections over eight days during the GSM season, sometimes on the same day as West Macgregor surveys (see figure). On the first seven visits GSM were observed or reported as flying on other sites on that day (Table 4.1).

Flying males were recorded in native pasture, Natural Temperate Grassland and areas dominated by Chilean Needlegrass, with a total of 47 males counted in about 17 hours of survey (see figure). None were seen in the tree plantations. Numbers were low in all areas, with most GSM seen in Chilean Needlegrass on the creek flats. Probable food plants in the drier grasslands included wallaby grasses (*Rytidosperma auriculatum*, *R. carphoides*, *R. erianthum*, *R. laeve*, *R. racemosum*), and Speargrasses (*Austrostipa bigeniculata*, *A. scabra*). No females were recorded, and no pupal cases were found during searches of 27 patches of probable or known GSM habitat.

The distribution of GSM at Jarramlee in 2014 is consistent with observations made in two previous surveys, which also found higher numbers on the creek flats (Braby 2005, Biosis 2010). Biosis also surveyed Jarramlee in 2014, and both sets of results should be considered together.

Table 4.1. Golden Sun Moth records at Jarramlee, 2014.

Date	Time	Conditions	Number of male GSM	GSM activity at other sites on same date
14 Nov	1220-1235	28°C, sunny, wind light to medium.	4	West Macgregor, Yarralumla, Barton
22 Nov	1150-1415	26-29°C, sunny, wind light (pupal case survey, none found)	10	Majura West, Uni of Canberra
26 Nov	1140-1420	21-26°C, sunny, wind light to medium. (pupal case survey, none)	13	Majura West, Uni of Canberra, Ainslie
2 Dec	1100-1230	26-28°C, sunny to part cloud, wind medium to high. (no pupal cases)	0	Majura West, Ainslie
10 Dec	1130-1500	24-28°C, cloud increasing, still to light wind	12	West Macgregor, Wallaroo Rd NSW
18 Dec	1130-1450	23-27°C, sunny, wind light to medium	4	Majura Parkway
19 Dec	1250-1305	23°C, sunny, light wind	3	West Macgregor, Wallaroo Rd Hall ACT
20 Dec	1130-1340	21-23°C, sunny, wind light (pupal case survey, none found)	1	No reports
<b>TOTAL</b>	<b>~ 17 hours</b>		<b>47</b>	

#### 4.1.3 Other observations

Thirty three species of native birds were recorded during the surveys. This included White-winged Triller which is listed as a vulnerable species in the ACT, and Diamond Firetails and Spotted Harrier (both vulnerable in NSW). One Diamond Firetail was carrying nesting material. Other highlights included Dusky Woodswallow, Little Grassbird, Brown Songlark, Rufous Songlark, and Pacific Heron and Black-fronted Plovers on Ginninderra Creek.

#### 4.1.4 Comments

Numbers of flying GSM at Jarramlee were low on every visit, but on three of the survey dates moderate numbers of GSM were recorded at other sites by this or another observer, suggesting that most of the GSM habitat at Jarramlee is relatively poor.

Continued cattle grazing, rabbit control and weed control are necessary to improve and maintain the structure and composition at this site. Chilean Needlegrass control should be continued above the fence bordering the creek flats.

## 4.2 West Macgregor

### 4.2.1 Vegetation and habitat condition

The vegetation at West Macgregor is similar to the previous description of this site (Hogg 2005). The flat land along Ginninderra Creek is densely vegetated with exotic grasses and mostly dominated by Chilean Needlegrass. The grassland on the hill to the southwest of Ginninderra Creek contains weedy native Speargrass/Wallaby Grass pasture, with some Ryegrass and annual exotic grasses, Subterranean Clover, Paterson's Curse and Saffron Thistle. The paddock north of the tree plantation contains more open native pasture with some scattered native forbs in the western part.

The grasslands were mostly moderately dense, low to medium in height, with little bare ground, and were being grazed by a small number of cattle and Eastern Grey Kangaroos.

### 4.2.2 Golden Sun Moth observations

West Macgregor was surveyed over four days, and flying male GSM were seen on all parts of the site except in the tree plantation at the northern end (figures and Table 4.2). On each visit there were moderate to high numbers of flying males in areas dominated by Chilean Needlegrass along Ginninderra Creek, and lower numbers in the native pasture areas. Potential larval food plants in the native grasslands included wallaby grasses (*Rytidosperma auriculatum*, *R. carphoides*, *R. racemosum*), and Speargrasses (*Austrostipa bigeniculata*, *A. scabra*). The distribution of GSM was similar to two previous surveys (Braby 2005, Biosis 2010) and the relative densities of flying males were similar to one previous survey (Braby 2005). 1064 males were recorded in eight hours of survey, and two females and four pupal cases were seen in the Chilean Needlegrass area (see photograph).

Table 4.2. Golden Sun Moth records at West Macgregor, 2014.

Date	Time	Conditions	Number of male GSM	GSM activity at other sites on same date
14 Nov	1100-1305	26-30°C, sunny, wind light to medium	135	Jarramlee
10 Dec	1155-1400	26-28°C, part cloud, wind light	340	Jarramlee, Wallaroo Rd NSW
15 Dec	1015-1220	23-28°C, sunny, light wind	555	Majura Parkway, NSW near Dunlop ACT
19 Dec	1100-1240	23°C, sunny, light wind (pupal case survey, 4 found)	34	Jarramlee, Wallaroo Rd nr Hall ACT
<b>TOTAL</b>	<b>~ 8 hours</b>		<b>1064</b>	



Pupal case of Golden Sun Moth protruding from thatch.

#### 4.2.3. Comments

Continued cattle grazing is necessary to control the biomass at this site, and weed control should continue in the native pasture areas.

### 4.3 Lot 1, DP 1144979 Yass NSW

#### 4.3.1 Vegetation and habitat condition

The vegetation for this site has previously been mapped in detail (KBR 2014a), and a Vegetation Management Plan (KBR 2014b) has been prepared. The condition of Lot 1 appears to have changed since spring 2013, as the previous studies do not mention Subterranean Clover *Trifolium subterraneum* as being present, or that Wild Oat *Avena fatua* is very common on the site. In spring 2014 these two species were so common that it was not possible in many areas to confirm the composition of the community under these weeds (see photographs).

This change is probably due to rain in autumn 2014 combined with the removal of stock. The VMP prescribes grazing regimes for different paddocks on the site, but this may not have been implemented as the internal fencing has not been upgraded yet. No stock were present during the surveys. A group of ten kangaroos was seen on the site.

Patches of Natural Temperate Grassland were identifiable in small parts of the areas mapped as NTG in the above reports, mainly in areas where rock or vehicle movements had suppressed the growth of oats and clover. An additional small patch of NTG (ca 0.25 ha) was found on the central southern boundary of the site. This low open patch contained many Blue Devil *Eryngium ovinum* plants (see photograph).



Native speargrass pasture obscured by Wild Oats, north-eastern paddock of Lot 1.



Speargrass tussocks visible after slashing of Wild Oats, north-eastern paddock of Lot 1.



Scattered speargrass tussocks among a mat of dead Subterranean Clover, with new clover germinating, central paddock of Lot 1.



Natural Temperate Grassland patch with Yellow Buttons *Chrysocephalum apiculatum* and Blue Devil *Eryngium rostratum*, at southern boundary fence of Lot 1.

### 4.3.2 Golden Sun Moth observations

Lot 1 was surveyed over four days, with very low numbers of flying males recorded on each visit (figures and Table 4.3). On one of these days moderate numbers were recorded at an ACT site. On three of the visits flying males were seen in an area of shorter native pasture south-west of the woodland and in an adjacent double-fenced easement. Potential larval food plants in areas containing GSM included wallaby grasses (*Rytidosperma auriculatum*, *R. carphoides*, *R. erianthum*) and Speargrasses (*Austrostipa bigeniculata*, *A. scabra*). Occasional males were also seen in small patches of Natural Temperate Grassland under the powerlines in the south-western part of the site (see photograph). The distribution of GSM was very similar to that reported by Jessop (2014a), though higher numbers were found in that survey.

No females were recorded, and three pupal cases were found in searches of 12 patches of apparently suitable habitat. The pupal cases were found in low open native pasture in the double-fenced easement (see photograph).

Table 4.3 Golden Sun Moth records at Lot 1 NSW, 2014.

Date	Time	Conditions	Number of male GSM	GSM activity at other sites on same date
21 Nov	1115-1515	27-30°C, sunny, wind light to medium	5	Throsby Neck
9 Dec	1030-1345	22-26°C, part cloud, wind light	1	Wallaroo Rd nr Hall, ACT
10 Dec	1030-1120	23-24°C, part cloud, wind light	4	Jarramlee, West Macgregor
22 Dec	1100-1415	28-31°C, sunny then increasing cloud, wind light to medium	2	No reports
<b>TOTAL</b>	<b>~ 11.5hrs</b>		<b>12</b>	

### 4.3.3 Comments

At the time of the surveys Lot 1 was in poor condition, with very dense vegetation in many areas and high weed cover. It appears that grazing regime in the Vegetation Management Plan has not yet been implemented. However, the patchy distribution of GSM was very similar to that reported in Jessop (2014a), suggesting that large areas of Lot 1 are currently poor habitat for GSM.



Small patch of Natural Temperate Grassland under powerline in south-west of Lot 1 where occasional GSM were recorded.



Native pasture with bare ground in easement in centre of Lot 1 where male GSM and pupal cases were found.

#### 4.4 Lot 2, DP 1144979 Yass NSW

##### 4.4.1 Vegetation and habitat condition

The vegetation at Lot 2 was similar to the previous mapping (KBR 2014a), although in poorer condition. There was an additional small patch of Natural Temperate Grassland noted under the powerlines in the south-west of the site. Vegetation condition was similar to Lot 1, with patches of Wild Oats and Subterranean Clover across much of the Natural Temperate Grassland (see photographs). Many native forbs were still present in these areas, and Chocolate Lilies were flowering. The Natural Temperate Grassland near the creek in the north of the site also contained many woody weeds. The area previously mapped as Austrostipa native grassland in the west of the site did contain native grasses, but was very disturbed and weedy and did not appear to be GSM habitat.

A group of 30 kangaroos was seen on the site, mainly feeding beside the creek. No stock were present during the surveys.



Natural Temperate Grassland containing GSM near creek in north of Lot 2.



Thick patches of Subterranean Clover (foreground) and Wild Oats (background) among Natural Temperate Grassland in north of Lot 2.



Patch of Natural Temperate Grassland in rocky area under powerlines in eastern part of Lot 2.

#### 4.4.2 Golden Sun Moth observations

Low numbers of flying males were seen on the first three visits to Lot 2, and none were seen on the final visit (figures and Table 4.4). On 15 December when few GSM were seen at Lot 2, moderate numbers were recorded at three ACT sites. No females or pupal cases were found.

All GSM were in patches of Natural Temperate Grassland in varying condition on the margins of the site. Potential larval food plants in areas containing GSM included wallaby grasses (*Rytidosperma auriculatum*, *R. carphoides*, *R. erianthum*, *R. pilosum*) and Speargrasses (*Austrostipa bigeniculata*, *A. scabra*).

GSM numbers and distribution were very similar to the previous survey (Jessop 2014a), suggesting that most of Lot 2 is poor habitat for GSM, but the site has value as a corridor linking GSM sites along Gooromon Ponds Creek.

Table 4.4 Golden Sun Moth records at Lot 2 NSW, 2014.

Date	Time	Conditions	Number of male GSM	GSM activity at other sites on same date
28 Nov	1150-1415	22-27°C, sunny, wind light to medium	28	Pialligo
8 Dec	1200-1345	27-28°C, sunny, wind light to medium	3	Majura Parkway, Ainslie
15 Dec	1130-1400	24-28°C, sunny, wind light	10	Majura Parkway, West Macgregor, Yarralumla, Barton
21 Dec	1130-1330	26-28°C, sunny, wind light (pupal case survey, none found)	0	No reports (none found in Dunlop NR)
<b>TOTAL</b>	<b>~ 8.5 hours</b>		<b>41</b>	

#### 4.4.4 Comments

As for Lot 1, implementation of the prescribed grazing regime will benefit the GSM habitat. Continued woody weed control is needed along the creek.

A Spotted Harrier *Circus assimilis* (listed as vulnerable in NSW) was seen at the site.

## 4.5 Block 48 Wallaroo Rd Hall ACT

### 4.5.1 Vegetation and habitat condition

The vegetation was similar to the previous mapping (KBR 2014c), with an overlay of Wild Oats and patches of St John's Wort across much of the site. The Natural Temperate Grassland east of the access road was dominated by Kangaroo Grass *Themeda triandra* (not a larval food plant), while the NTG on the ridge west of the road was mixed, with a higher component of Wallaby grasses (see photograph).

No stock were present during the surveys. About 30 kangaroos were seen on the site, mainly on the ridge west of the road.



Hall Block 48. Low Natural Temperate Grassland on the ridge west of the road, with Wallaby grasses, native forbs and bare ground.

### 4.5.2 Golden Sun Moth observations

Low to moderate numbers of flying males were seen on three of the four visits (figures and Table 4.5). All were west of the road, mostly in Natural Temperate Grassland on the ridge. A few were seen in a very narrow strip of native grassland bordering the eroded drainage line in the south-western part of the site.

Potential larval food plants in areas containing GSM included wallaby grasses (*Rytidosperma carphoides*, *R. caespitosum*, *R. laeve*, *R. pilosum*) and Speargrasses (*Austrostipa bigeniculata*, *A. scabra*).

The density and distribution of GSM were very similar to a previous survey (Jessop 2014b), except that one moth (a female) was seen east of the road in that survey.

Table 4.5 Golden Sun Moth records at Block 48 ACT, 2014.

Date	Time	Conditions	Number of male GSM	GSM activity at other sites on same date
29 Nov	1150-1400	22-29°C, sunny, still (pupal case survey, none found)	75	Kinlyside
3 Dec	1115-1305	27-30°C, high haze, wind light to medium	18	Majura Parkway
9 Dec	1100-1320	23-27°C, part cloud, wind light	58	Majura Parkway, Wallaroo Rd NSW
19 Dec	1335-1440	24°C, sunny, still to medium wind (pupal case survey, none found)	0	Jarramlee, West Macgregor
<b>TOTAL</b>	<b>~ 7.5 hours</b>		<b>151</b>	

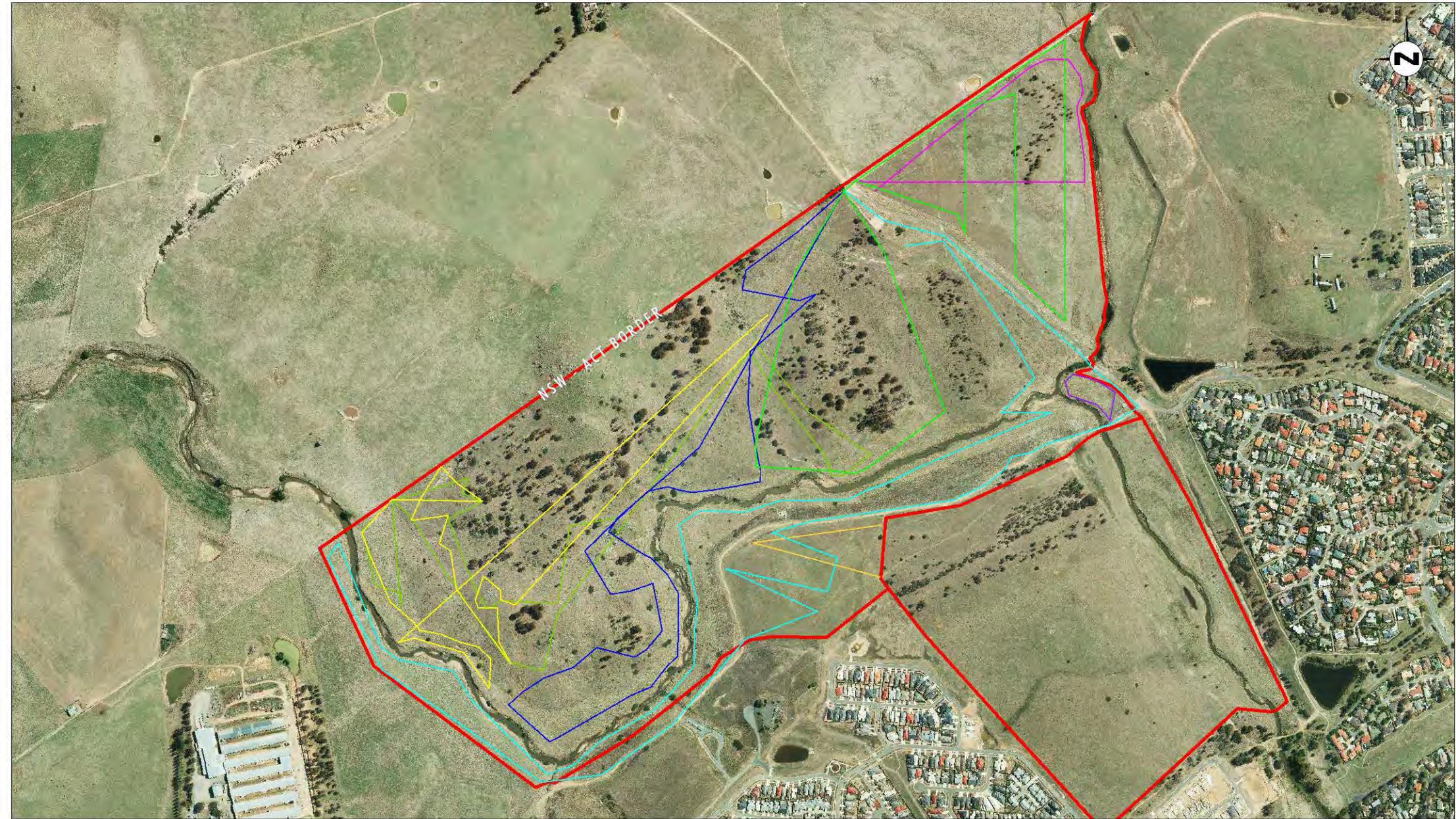
#### 4.5.3 Comments

No GSM were seen in the eastern part of the site in 2014, but the presence of a female east of the road in the 2013 survey suggests that there is occupied habitat in that area, as the females have limited flying ability and are likely to be found close to the site of larval development.

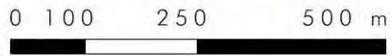
Some weeds are being controlled but St John's Wort was common at Block 48 this season. Continued grazing will be needed to control the biomass on this site.

## 5. References

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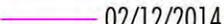
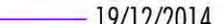
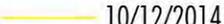
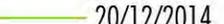
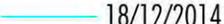


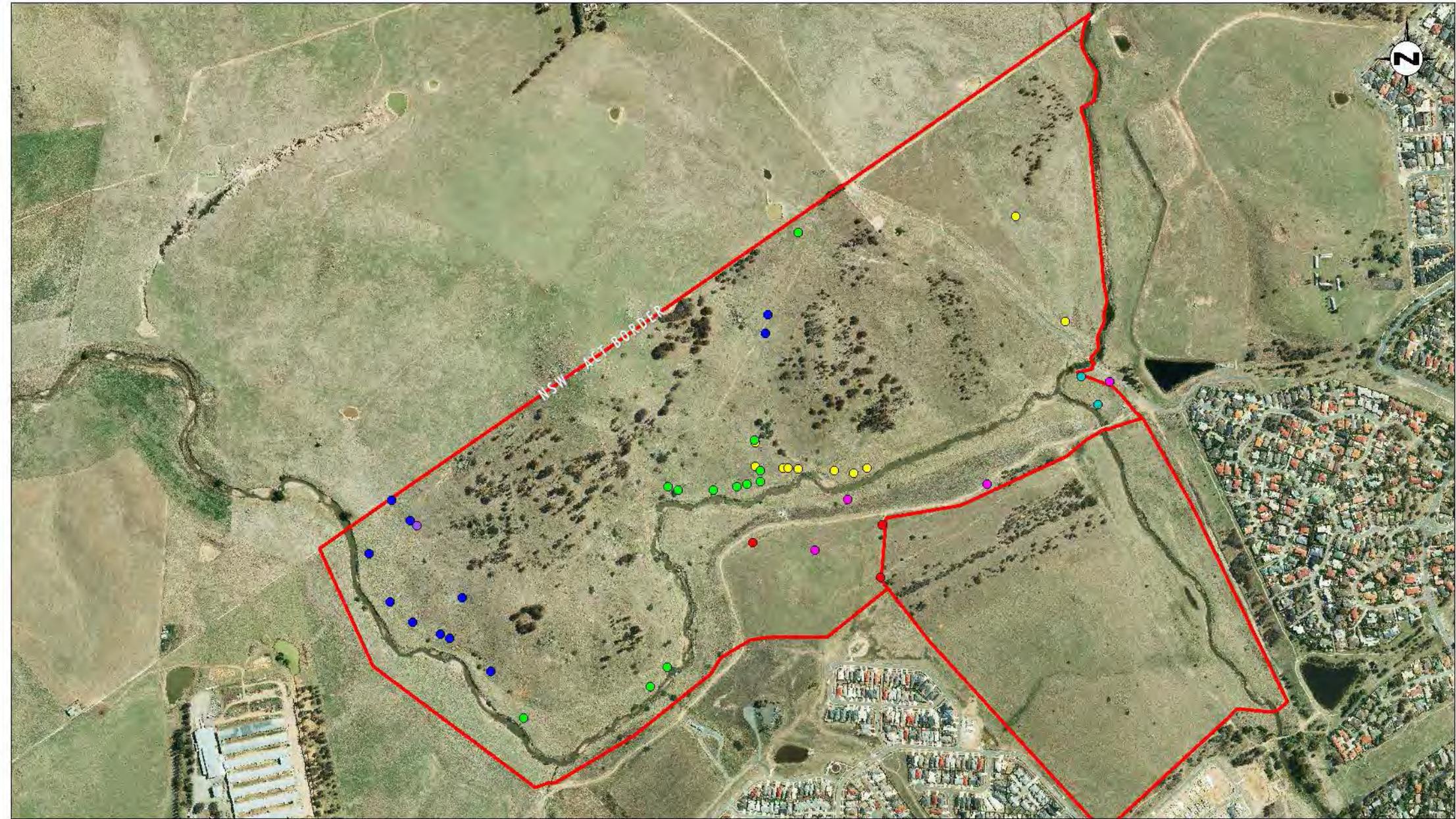
Source: Rowell (2015)



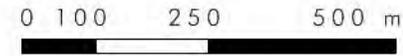
### Legend

Project Area  
 Jarramlee Offset Area

Survey Track and Date		
 14/11/2014	 02/12/2014	 19/12/2014
 22/11/2014	 10/12/2014	 20/12/2014
 26/11/2014	 18/12/2014	



Source: Rowell (2015)



### Legend

Project Area	Survey Date		Moth Density
Jarramlee Offset Area	14/11/2014	10/12/2014	20/12/2014
	22/11/2014	18/12/2014	1 - 3
	26/11/2014	19/12/2014	



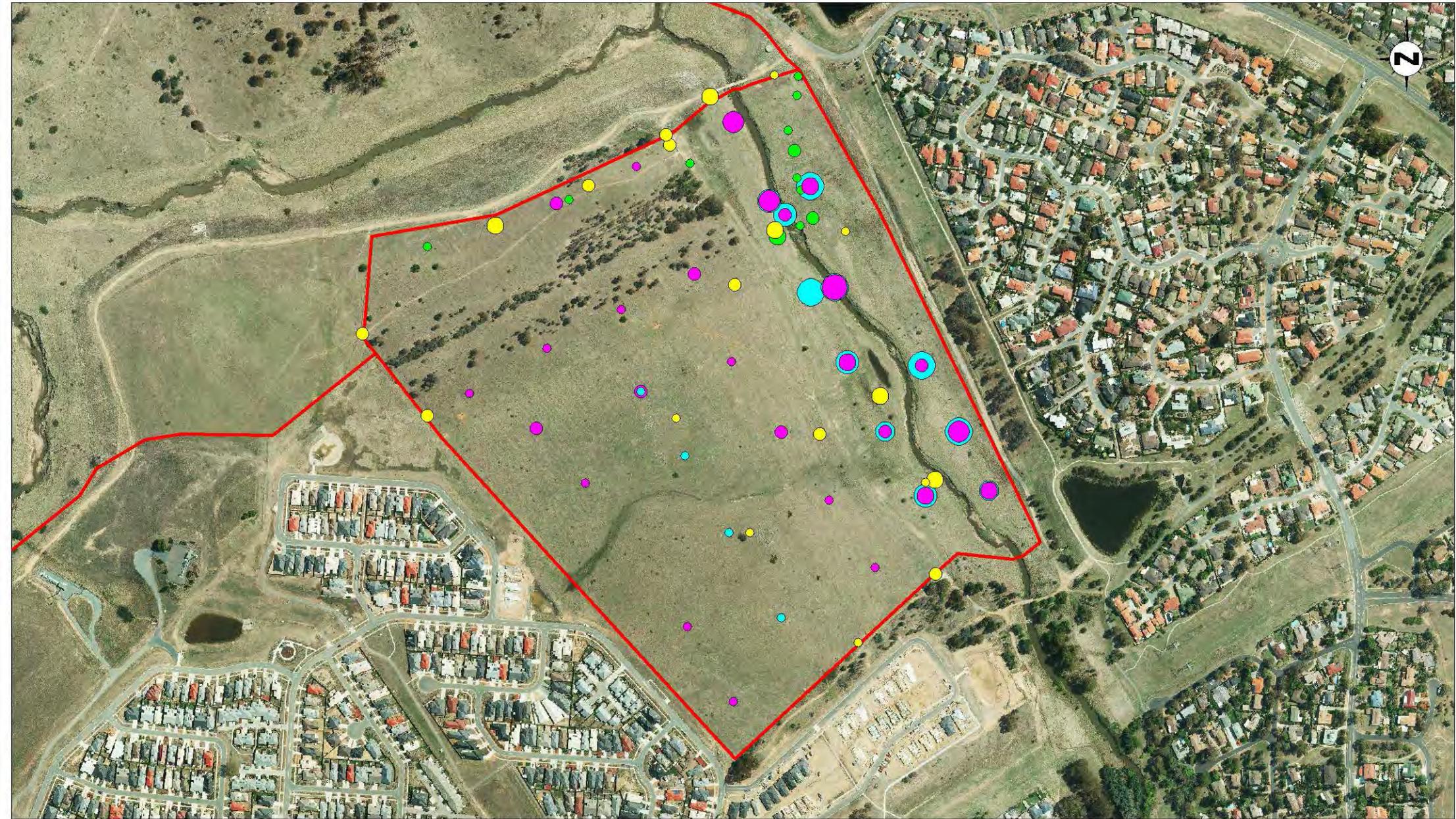
Source: Rowell (2015)

**Legend**

Project Area  
West Macgregor Offset Area

Survey Track and Date  
14/11/2014 15/12/2014  
10/12/2014 19/12/2014



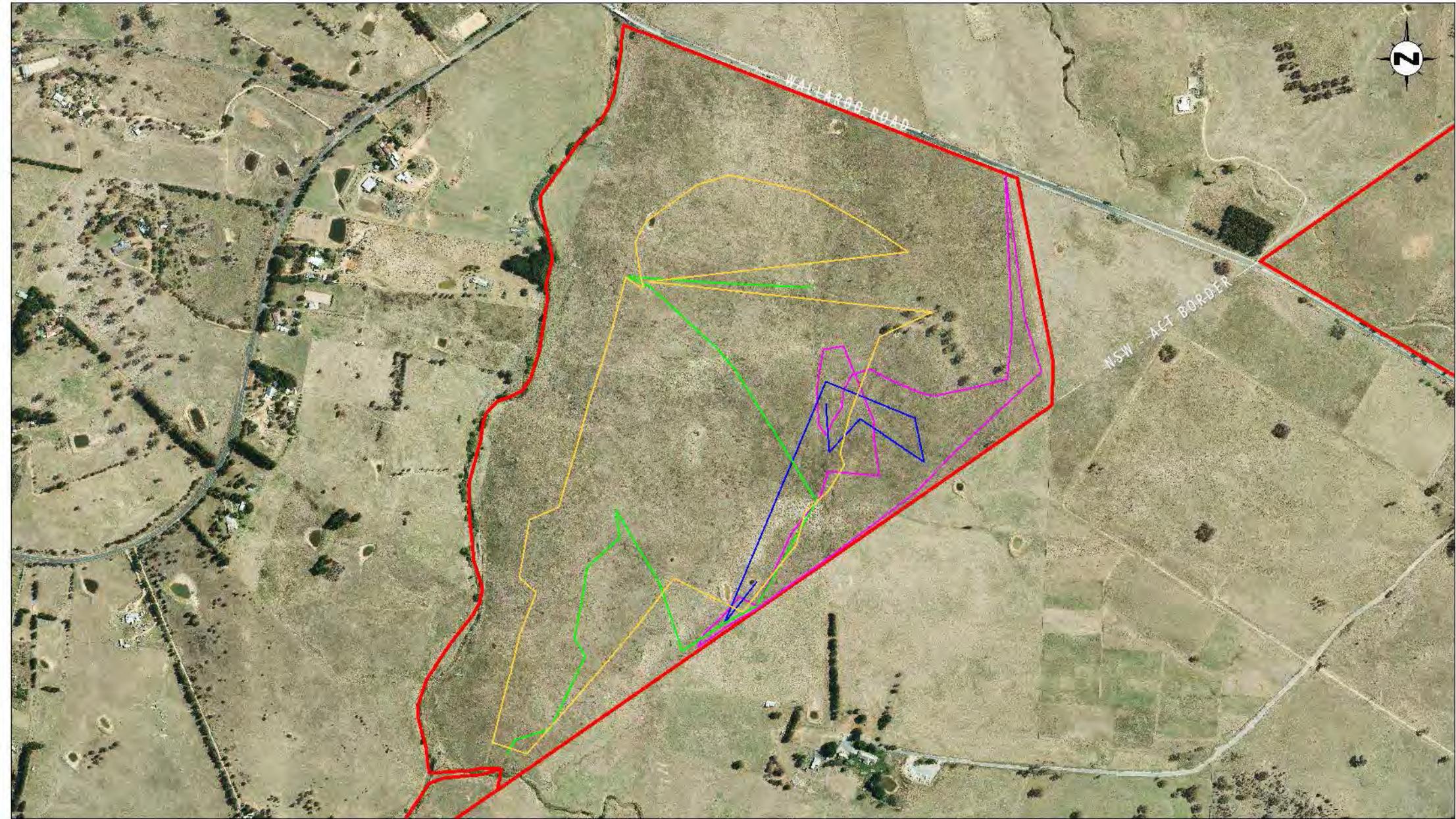


Source: Rowell (2015)

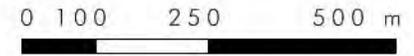


**Legend**

<b>Project Area</b>	<b>Survey Date</b>	<b>Moth Density</b>		
West Macgregor Offset Area	14/11/2014	15/12/2014	1 - 3	11 - 25
	10/12/2014	19/12/2014	4 - 10	51 - 100
			26 - 50	



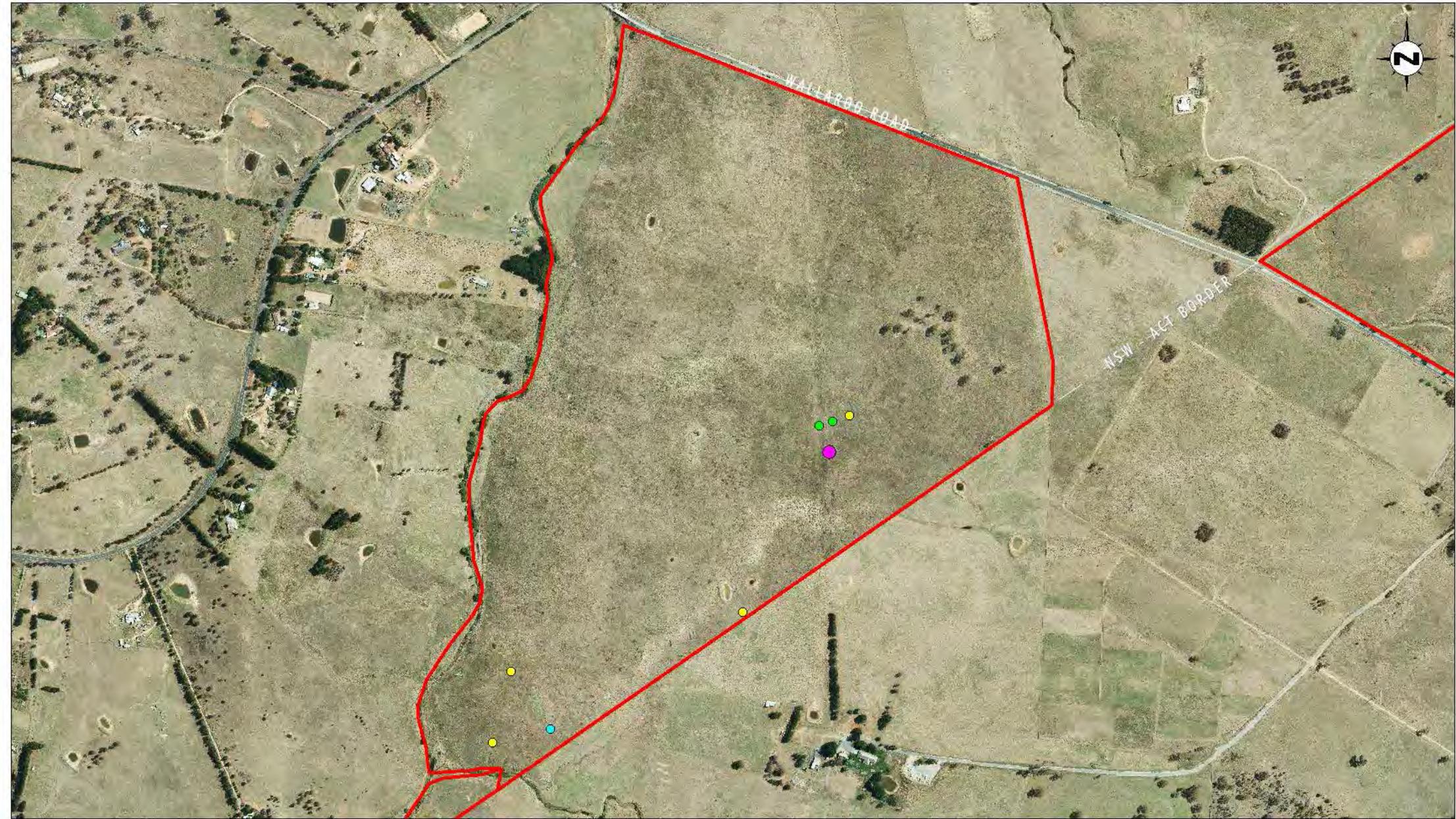
Source: Rowell (2015)



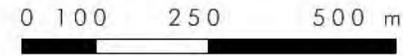
**Legend**

Project Area  
Lot 1, DP 1144979

Survey Track and Date  
21/11/2014 10/12/2014  
09/12/2014 22/12/2014



Source: Rowell (2015)

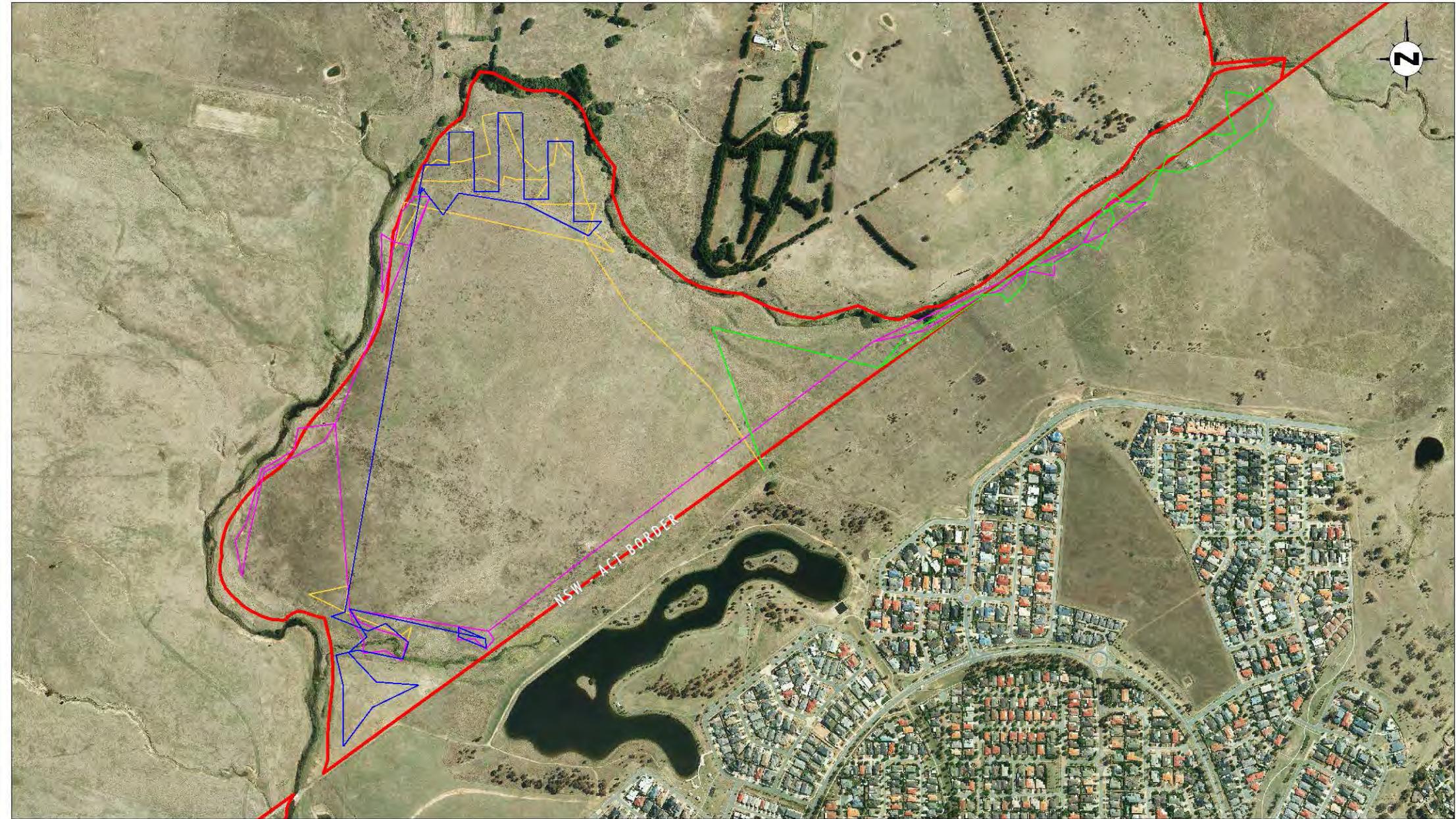


**Legend**

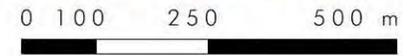
Project Area  
Lot 1, DP 1144979

Survey Date  
● 21/11/2014  
● 09/12/2014  
● 10/12/2014  
● 22/12/2014

Moth Density  
□ 1 - 3  
○ 4 - 10



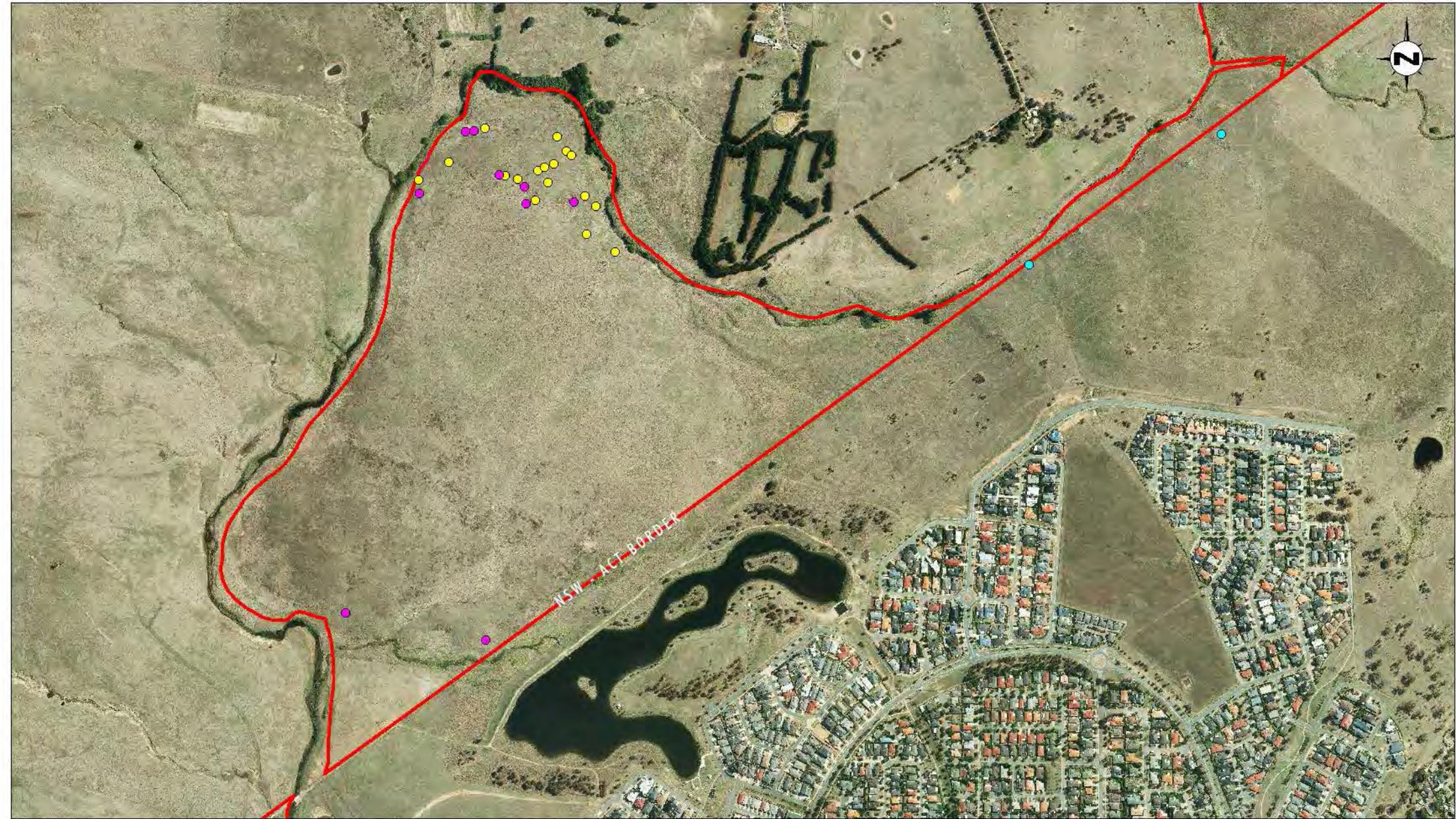
Source: Rowell (2015)



**Legend**

Project Area  
 Lot 2, DP 1144979

Survey Track and Date  
 28/11/2014     15/12/2014  
 08/12/2014     21/12/2014



Source: Rowell (2015)

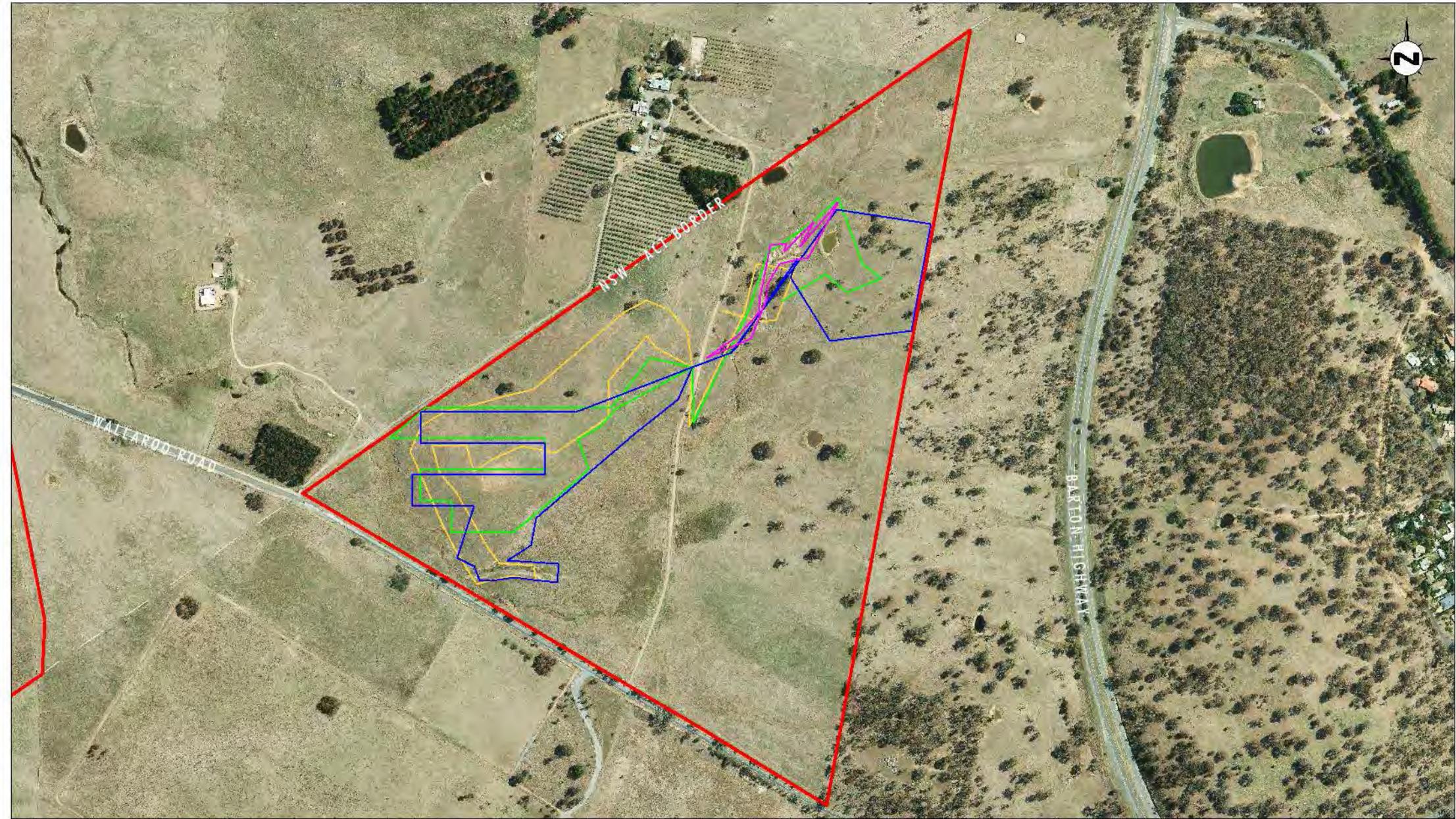
### Legend

Project Area  
Lot 2, DP 1144979

Survey Date  
● 28/11/2014    ● 15/12/2014  
● 08/12/2014    ● 21/12/2014

Moth Density  
□ 1-3



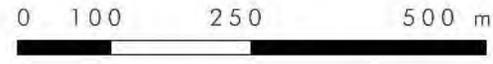


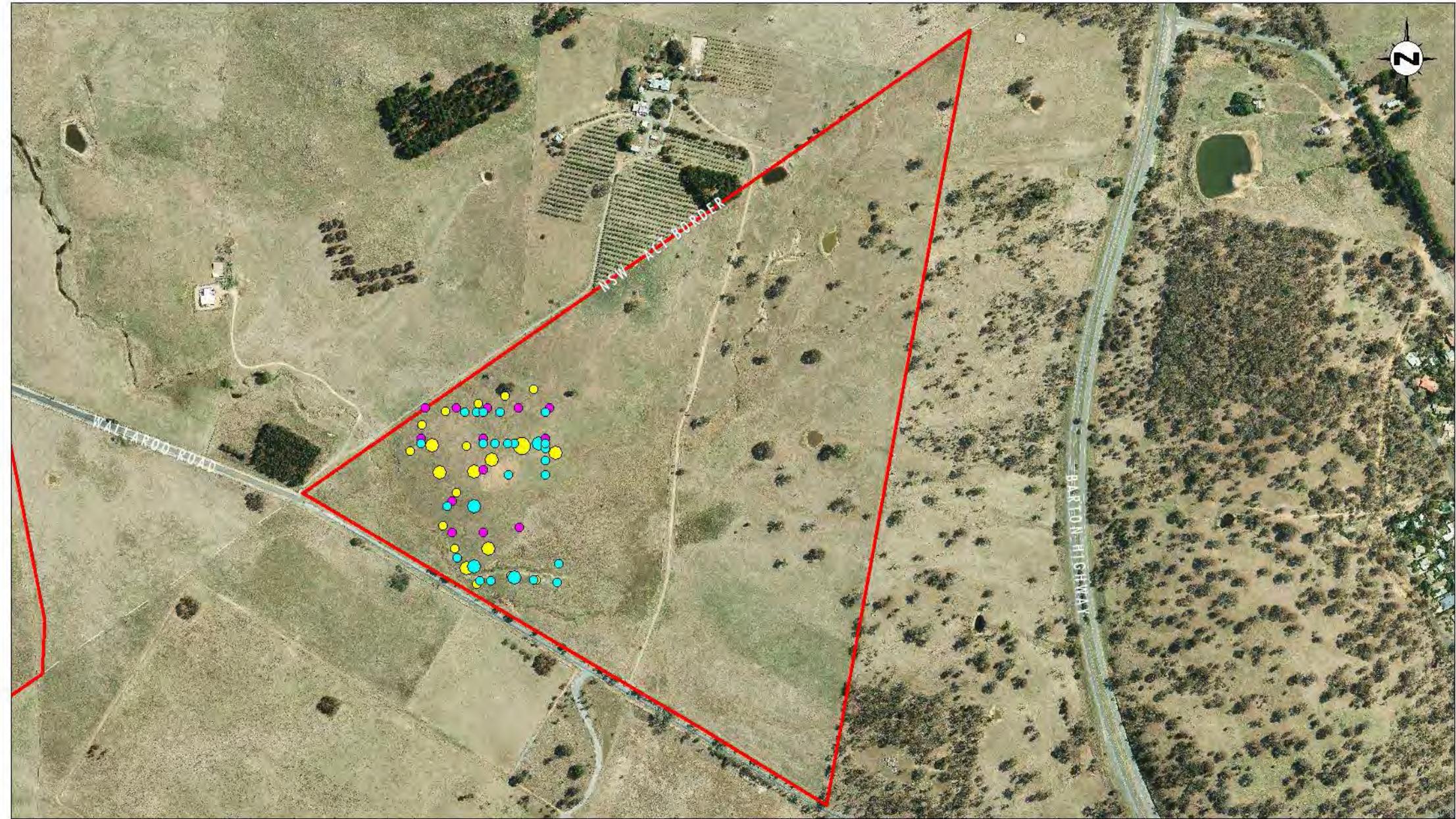
Source: Rowell (2015)

### Legend

Project Area  
 Block 48, Hall

Survey Track and Date  
— 29/11/2014 — 09/12/2014  
— 03/12/2014 — 19/12/2014





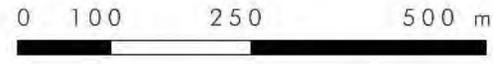
Source: Rowell (2015)

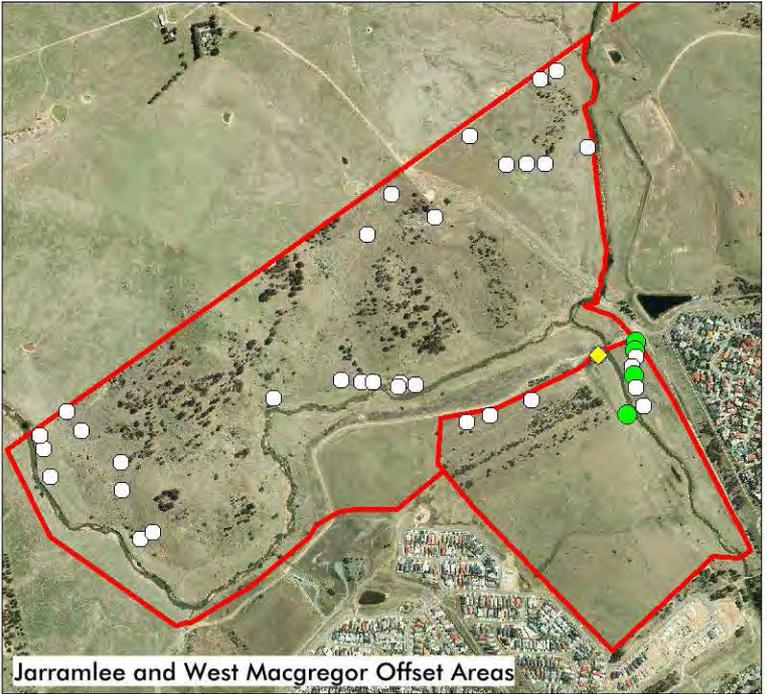
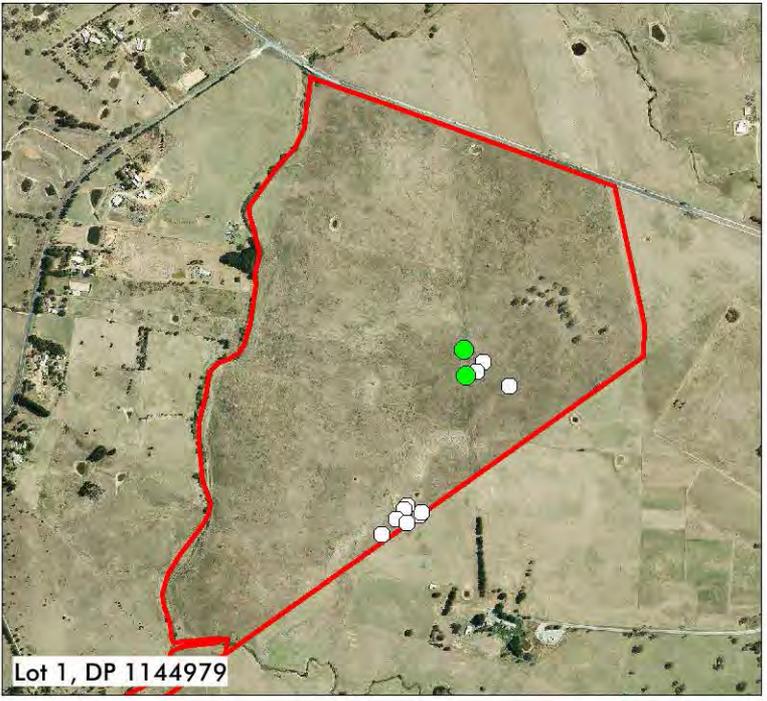
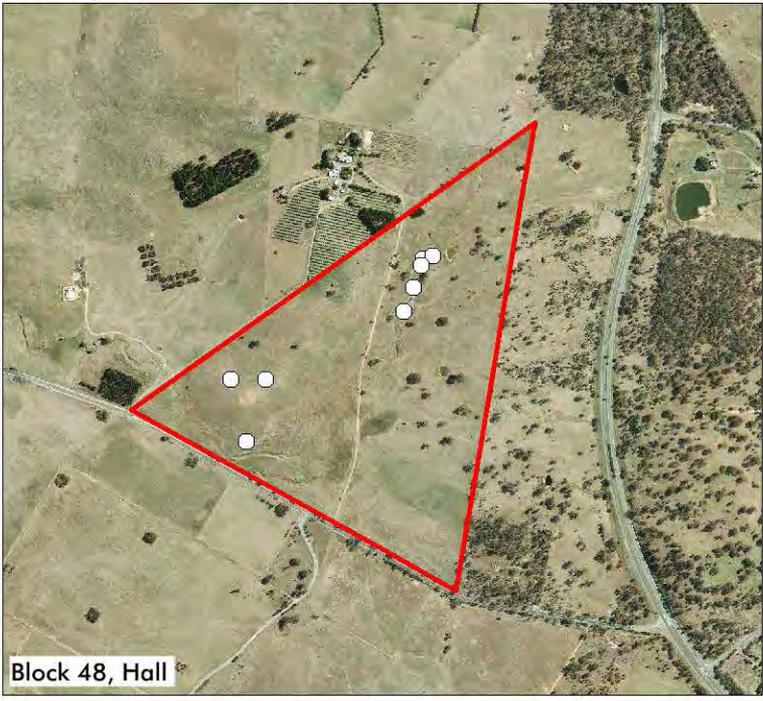
**Legend**

Project Area  
Block 48, Hall

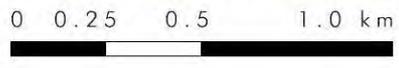
Survey Date  
29/11/2014  
09/12/2014  
03/12/2014

Moth Density  
1 - 3  
4 - 10  
11 - 25





Source: Rowell (2015)



### Legend

- Project Area
- Pupal Case Search (Absent)
- Female GSM Observed
- Pupal Case Search (Present)