Aurora Reserve 14:
Golden Sun Moth survey 2016/2017 season

Final report prepared for Development Victoria

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1. Introduction

Biosis Pty Ltd was commissioned by Development Victoria to conduct annual monitoring for Golden Sun Moth *Synemon plana* throughout the Aurora residential development area at Epping North, Victoria (Figure 1). Golden Sun Moth (GSM) is listed as a Matter of National Environmental Significance (MNES) under the *Environment and Protection Biodiversity Conservation Act 1999* (EPBC Act).

1.1 Golden Sun Moth Background

GSM are a medium sized, diurnal (day flying) moth with clubbed antennae (Edwards 1993). The species is sexually dimorphic, with the females having an enlarged abdomen and ovipositor that aids in egg laying. The species is also sexually dichromatic in wing colour. The forewings of females are brown and grey while the hind wings are yellow with black spots. Male GSM have dark brown forewings with grey scales and bronze-coloured hind wings. Females, which only fly irregularly, position themselves on the ground in a conspicuous location (usually in inter-tussock spaces), flashing their golden hind wings (petticoats) to the males, who fly low over the grasses searching for them.

GSM prefer warm, dry conditions (above 20°C with little to no wind and cloud) and are usually observed flying during the warm part of the day (between 10:00 and 14:00; Clarke and O'Dwyer 2000). Since 2005, Biosis have often observed GSM active on cooler days, with cloud cover and moderate to strong wind conditions and also at times earlier and later in the day than generally accepted as optimal observation times.

GSM breeding season begins in mid-October and continues through to early January (Commonwealth of Australia 2009). The breeding season differs slightly from year to year depending on climate and location. Adult moths emerge continuously in cohorts and males are seen actively flying in search of females.

Potential habitat for GSM consists of areas which support or had supported native grasslands or grassy woodlands (including derived grasslands) across the historical range of the species. Previous studies found that GSM display a preference for Wallaby Grasses *Rytidosperma* spp. (particularly *R. carphoides*, *R. auriculata*, *R. setacea*, *R. eriantha* and *R. racemosa*). However, more recent surveys have found GSM present in degraded grasslands and patches invaded with weedy species, including areas dominated by Red-leg Grass *Bothriochloa macra*, Spear Grasses *Austrostipa* spp. and Weeping Grass *Microlaena stipoides and* the introduced Chilean Needle-grass *Nassella neesiana* (Braby & Dunford 2006; Gilmore *et al.* 2008).

1.2 Aurora residential development background

Fourteen conservation reserves were initially established within the Aurora residential development. The reserves contain patches of native vegetation and fauna habitat that are being managed for the protection of biodiversity values, including threatened flora and fauna species. The reserves provide offsets which contribute to the project's net gain targets, which are part of the requirements of the Aurora development Conservation Management Plan (CMP).

All reserves were initially surveyed to determine the distribution of Golden Sun Moth within Aurora and provide management advice for the reserves. Monitoring throughout these reserves began in 2007/2008 and are scheduled to continue for 10 years under the CMP, as per the condition of approval under the EPBC *Act* referral for Aurora (EPBC 2007/3524).

Eleven of the reserves were sold to Lend Lease in 2015, but Reserve 10, 11 and 14 remain the property of Development Victoria. Of these three reserves, Reserve 14 is the only reserve required annual GSM monitoring under the CMP. This report highlights the monitoring results for the 2016-17 flight season within Reserve 14. The 2016/2017 season marks the eighth year of annual CMP monitoring.

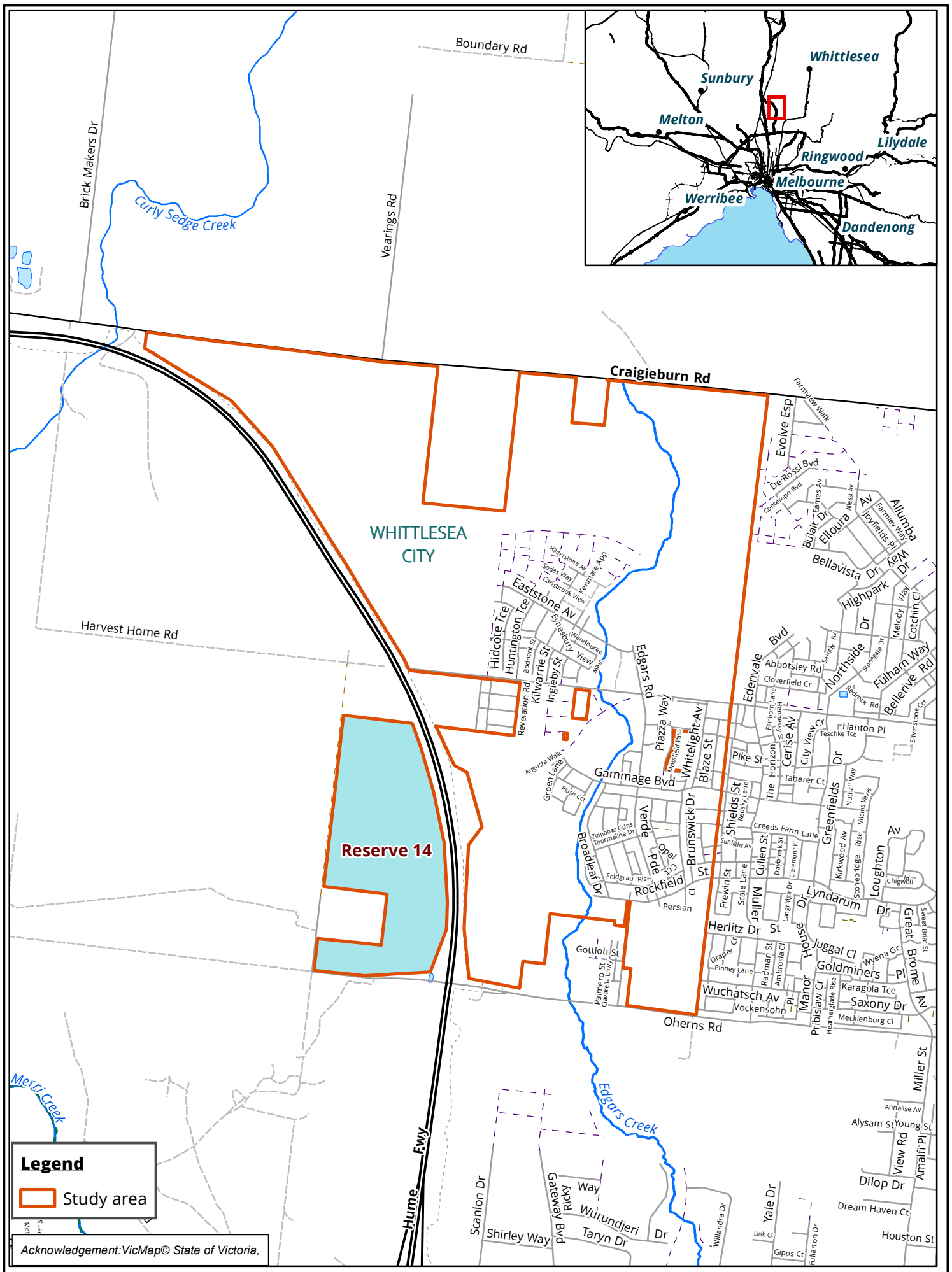

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Figure 1: Location of the Study Area - Aurora, Epping North, Victoria

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2. Methods

2.1 Determining flight season commencement

As the timing of flight season varies annually and throughout GSM geographical range, commencement of flight season needs to be determined before surveys are undertaken. Reconnaissance surveys to determine when the 2016/2017 flight season had commenced were conducted at Reserve 12, which has been recorded as containing the largest known GSM population at Aurora. Another known GSM location at Aurora south, adjacent to O'Herns Road, was also used as an additional reference site. GSM were first observed flying at Aurora on 7 December 2016.

2.2 Transect counts

During the 2016/17 flight season, walking transect counts were conducted to detect GSM presence and population trends within the Aurora reserves. This method has been employed since the 2014/15 flight season. Point count methods, which were employed for the initial five years of the survey, were abandoned after statistical analysis determined this to be less reliable than walking transect counts.

Monitoring surveys were undertaken on 12 December 2016 and 23 December 2016. Conditions on these days were suitable for male flight (above 20°C, minimal cloud cover and wind). Surveys commenced at 11:00am and concluded at approximately 2:00pm. Surveys were spaced at least one week apart to capture any variation in emergence patterns.

Surveys were conducted by qualified zoologists walking a series of transects approximately 50 m apart through Reserve 14. Tracks were recorded using a Garmin GPS and waypoints were taken for each location where GSM were observed.

Reserve 14 was surveyed twice throughout the 2016/2017 flight season. This level of survey effort was considered sufficient to achieve the objective of confirming continued GSM presence within the reserve and to accurately record GSM abundance.

2.3 Permits

Biosis conducted the GSM survey under a Research Permit for flora and fauna issued by the Department of Environment, Land, Water and Planning, under the *Wildlife Act 1975*, Flora *and Fauna Guarantee Act 1988* and *National Parks Act 1975* (Permit number 10007569, expiry date 30 April 2018).

2.4 Mapping

Mapping was conducted using hand-held (uncorrected) GPS units (WGS84) and aerial photo interpretation. The accuracy of this mapping is therefore subject to the accuracy of the GPS units (generally ± 7 metres) and dependant on the limitations of aerial photo rectification and registration.

3. Results

The continued presence of GSM at Reserve 14 was confirmed during the 2016/2017 flight season. GSM abundance on both survey dates are shown in Table 1and spatial distribution is displayed in Figure 2. A summary of historic GSM count data during the CMP annual monitoring is provided in Table 2 and Figure 3. Compared to the 2015/2016 flight season, GSM abundance within Reserve 14 increased and was the largest number of individuals recorded since the initial surveys in 2007/2008, prior to CMP implementation.

Table 1 Golden Sun Moth survey results at Reserve 14 for the 2016/2017 flight season.

Reserve Number	Number of GSM 12/12/2016	Number of GSM 23/12/2016	Total number of GSM 2016/2017 season
14	410	338	**748**

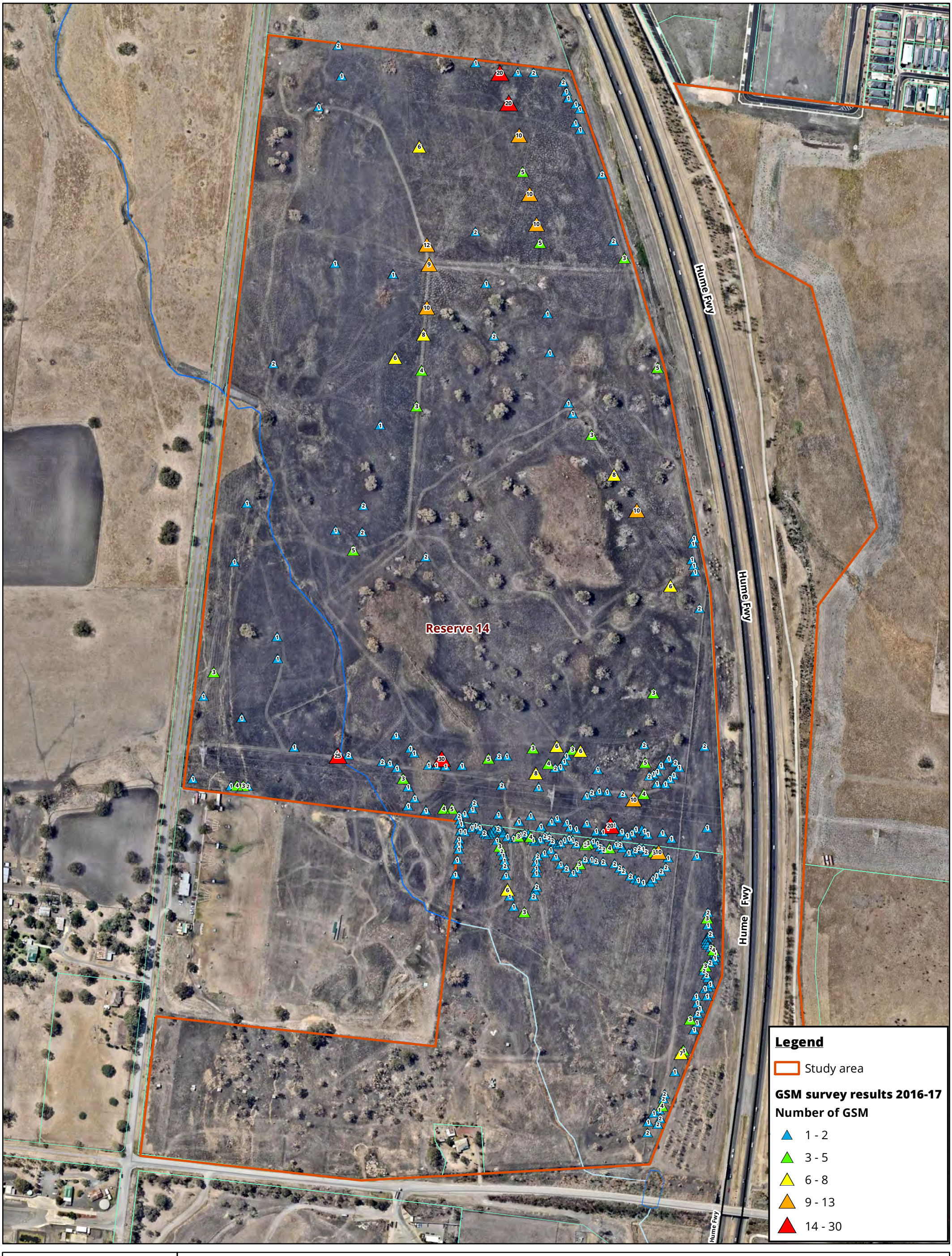

Figure 2: Aurora Golden Sun Moth survey results for the 2016–2017 flight season

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Acknowledgements: Imagery: NearMap

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Metres

Scale 1:4,000 @ A3
Coordinate System: GDA 1994 MGA Zone 55

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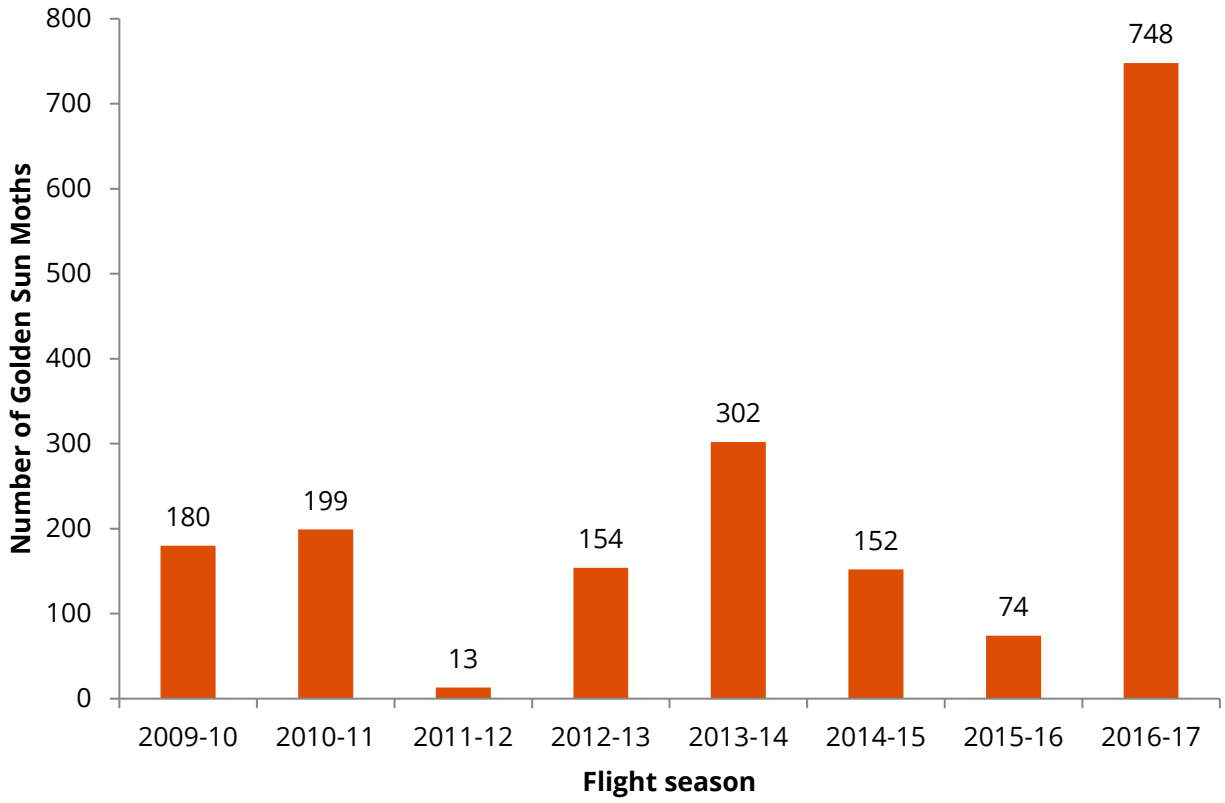
Table 2 Historic Golden Sun Moth monitoring counts within Reserve 14.

Reserve	Monitoring Point	Number of GSM 2009/2010	Number of GSM 2010/2011	Number of GSM 2011/2012	Number of GSM 2012/2013	Number of GSM 2013/2014	Number of GSM 2014/2015	Number of GSM 2015/2016	Number of GSM 2016/2017
14	14.1	6	3	0	3	33	-	-	-
	14.2	68	2	0	0	6	-	-	-
	14.3	3	0	0	1	6	-	-	-
	14.4	0	0	0	2	0	-	-	-
	14.5	13	10	0	15	0	-	-	-
	Incidental observations	90	184	13	133	257	152	74	748
TOTAL		**180**	**199**	**13**	**154**	**302**	**152**	**74**	**748**

* Numbers of observed Golden Sun Moth for the 2014/2015, 2015/2016 and 2016/2017 flight seasons are recorded as incidental observations as they were not recorded from the point count locations used in previous flight season surveys.

Figure 3 Historic Golden Sun Moth Golden Sun Moth monitoring counts within Reserve 14.



4. Discussion and conclusions

A total of 748 GSM were observed at Reserve 14 this season across two days of surveys. This was the highest number of GSM recorded since initial, pre-CMP surveys 2007/2008. Reserve 14 is the largest of the reserves at Aurora and has some of the best GSM habitat available throughout the Aurora residential development.

There was a notable increase in the number of GSM recorded at Aurora's Reserve 14 this year compared to previous study years. The constant fluctuation in the GSM populations at Reserve 14 highlights the importance of long-term monitoring projects which identify natural fluctuations in populations. Variation in population size of the GSM at Reserve 14 aligns with the widely acknowledged view that GSM abundance at any given site can vary tremendously both within and between seasons. Furthermore, survey method and effort has fluctuated throughout the continued monitoring of GSM at Reserve 14, having included both point counts and transect monitoring. Differences in survey effort can influence the number of GSM recorded at any given site.

During 2016, increased levels of rainfall occurred throughout the greater Melbourne area. Research by Kutt *et al*. (2015) suggests that higher than average rainfall correlates to reduced GSM populations in the flight season. Although GSM abundance was high throughout Reserve 14 during 2016/2017, increased rainfall during 2016 could have potential effects on the abundance of GSM during the next of monitoring in 2017/2018.

Populations of GSM across the Aurora residential development have continued to be observed at Reserve 12 and 14, with smaller number also observed at Reserve 6, 9 and 13. Management of Reserves 12 and 14 for GSM is more likely to be effective as they are larger and have better quality habitat throughout.

Recommendations

To ensure the GSM population continues to persist throughout Aurora's Reserve 14, there needs to be a strong focus on habitat management, in particular biomass reduction. GSM are known to prefer grasslands of low biomass that are dominated by grasses such as *Austrostipa* spp. and *Rytidosperma* spp. (Dorrough *et al.* 2004). Methods such as grazing and prescribed burning can be beneficial to ensure GSM habitat is present (O'Dwyer & Attiwill 2000).

Additionally, Toowoomba Canary-grass *Pharalis aquatica* was also found to be present within Reserve 14. This, when allowed to grow freely, outcompetes the GSM preferred Chilean Needle-grass and/or native grasses. Furthermore, the growth pattern of Toowoomba Canary-grass is not indicative of tussock forming grasses in which female GSM prefer to lay their eggs (Gilmore *et al.* 2008). Recent research suggests that GSM will avoid sites that are dominated by Toowoomba Canary-grass (Richter *et al*. 2013).

Therefore, we recommend that the Toowoomba Canary-grass biomass in Reserve 14 is managed by slashing/mowing or grazing in accordance with the Conservation Management Plan. This will to reduce biomass and provide habitat conducive to GSM.

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