

Final Report

Offset Management Plan: Mount Gow, Shelford, Victoria (EPBC 2018/8260)

Prepared for

CH2M Beca (on behalf of Western Water)

February 2021



Ecology and Heritage Partners Pty Ltd

DOCUMENT CONTROL

Assessment	EPBC 2018/8260: Offset Management Plan
Address	Mount Gow, Shelford, Victoria
Project number	10223
Project manager	Claire Ranyard (Senior Botanist)
Report reviewer	Aaron Organ (Director – Principal Ecologist)
Mapping	Dr Monique Elsley (GIS Coordinator)
File name	10223_EHP_Parwan-Melton-Pipeline_OMP_Final_09022021
Client	CH2M Beca (on behalf of Western Water)
Bioregion	Victorian Volcanic Plain
CMA	Corangamite
Council	Golden Plains Shire

Report versions	Comments	Comments updated by	Date submitted
Draft 01	Submitted to DAWE	-	30/10/2019
Draft 02	Addressed first round of comments from DAWE	AF	28/02/2020
Draft 03	Addressed second round of comments from DAWE	CR	12/05/2020
Draft 04	Addressed third round of comments from DAWE	CR	28/05/2020
Draft 05	Addressed fourth round of comments from DAWE	CR	20/07/2020
Final	Removed 3.45 NTGVVP offset from OMP	CR	09/02/2021

Copyright © Ecology and Heritage Partners Pty Ltd

This document is subject to copyright and may only be used for the purposes for which it was commissioned. The use or copying of this document in whole or part without the permission of Ecology and Heritage Partners Pty Ltd is an infringement of copyright.

Disclaimer

Although Ecology and Heritage Partners Pty Ltd have taken all the necessary steps to ensure that an accurate document has been prepared, the company accepts no liability for any damages or loss incurred as a result of reliance placed upon the report and its contents.

GLOSSARY

Acronym	Description
Approval holder	means the persons to whom the approval is granted, or to whom the approval is transferred under section 145B of the EPBC Act (persons taking the action).
CaLP	<i>Catchment and Land Protection Act 1994</i>
CMA	Catchment Management Authority
DELWP	Victorian Department of Environment, Land, Water and Planning
DEWHA	(former) Commonwealth Department of Environment, Water, Heritage and the Arts
DAWE	Commonwealth Department of Agriculture, Water and the Environment
DSEWPaC	(former) Commonwealth Department of Sustainability, Environment, Water Population and Communities.
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
EVC	Ecological Vegetation Class
FFG Act	<i>Flora and Fauna Guarantee Act 1988</i>
GSM	Golden Sun Moth
NES	National Environmental Significance
NTGVVP	Natural Temperate Grassland of the Victorian Volcanic Plain
OMP	Offset Management Plan
TfN	Trust for Nature

DECLARATION OF ACCURACY

I declare that:

1. To the best of my knowledge, all the information contained in, or accompanying this Management Plan (EPBC 2018/8260: Offset Management Plan: Parwan to Melton Pipeline, Victoria) is complete, current and correct.
2. I am duly authorised to sign this declaration on behalf of the approval holder.
3. I am aware that:
 - a. Section 490 of the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) makes it an offence for an approval holder to provide information in response to an approval condition where the person is reckless as to whether the information is false or misleading.
 - b. Section 491 of the EPBC Act makes it an offence for a person to provide information or documents to specified persons who are known by the person to be performing a duty or carrying out a function under the EPBC Act or the *Environment Protection and Biodiversity Conservation Regulations 2000* (Cth) where the person knows the information or document is false or misleading.
 - c. The above offences are punishable on conviction by imprisonment, a fine or both.

Signed

Full name (please print)

Organisation (please
print)

Date

EXECUTIVE SUMMARY

Introduction

Ecology and Heritage Partners Pty Ltd was engaged by CH2M Beca to prepare an Offset Management Plan (OMP) to compensate for impacts associated with the proposed recycled water pipeline, Parwan to Melton, Victoria (EPBC 2018/8260).

The intention of this OMP is to detail the offset strategy to mitigate the loss of 5.26 hectares of Golden Sun Moth *Synemon plana* (GSM) habitat at the development site. This is achieved by outlining management actions for the protection of 26.5 hectares of GSM habitat at a site located at Mount Gow, Victoria. This OMP has been written in consultation with the landowner of the offset site (██████████) and is intended to be implemented by the landowner (Note: Landowner name removed from document during public comment period to protect privacy).

The proposed GSM offsets outlined within this OMP comprise a parcel/s of land and not the entire Mount Gow property. This will be managed concurrently with the area covered by this management plan.

Proposed Offset Site

A large portion of the proposed offset area within the Mount Gow property contains patches of high-quality Plains Grassland, with the remaining areas of lesser quality due to a higher exotic grass cover. The offset site contains known habitat for GSM and patches of high-quality Plains Grassland which meet the key criteria for listing as the nationally significant community *Natural Temperate Grassland of the Victorian Volcanic Plain* (NTGVVP). In accordance with the *Planning and Environment Act 1987*, 26.5 hectares of GSM habitat will be protected on-title through a Section 173 Agreement as an interim mechanism, and secured via a Trust for Nature covenant under the *Victorian Conservation Trust Act 1972* within 24 months post approval.

Management Actions

The offset site will be managed for the purposes of conservation and will involve physical protection of the GSM habitat, through the control of pest animals and environmental weeds, biomass reduction and general maintenance of the character and quality of the native vegetation, consistent with its historic context. The landholder will adopt an adaptive management approach to allow flexibility to respond appropriately and effectively to uncertainties involved in ecological processes. This will ensure that management objectives are being met while allowing for altered circumstances to be included in the management of the offset site.

Any proposed changes to the management actions for the offset site contrary to those specified within this plan must be approved by the Commonwealth Department of Agriculture, Water and Environment (DAWE) prior to implementation. Any proposed uses or development of the offset site which conflict with the landowners' commitments or maintenance/improvement of the community are not permitted under this plan.

CONTENTS

DECLARATION OF ACCURACY	4
EXECUTIVE SUMMARY.....	5
1 INTRODUCTION.....	7
1.1 Background.....	7
2 OBJECTIVES AND CONTEXT OF THE PROJECT.....	8
2.1 Impact Site	8
2.2 Offset Site.....	8
3 RISK ASSESSMENT	10
4 UNAVOIDABLE LOSS AND OFFSET OBLIGATIONS	15
4.1 Unavoidable Loss	15
4.2 Offset obligations, user inputs and applying the offset guide.....	15
5 OFFSET IMPLEMENTATION	20
5.1 Management Objectives and Strategy.....	20
5.2 Compliance with Offset Principles	20
5.3 Offset Targets	20
5.4 Ongoing Land-use Commitments.....	21
5.5 Management Actions.....	21
5.6 Management Actions Table	35
6 CONTINGENCY RESPONSE AND CORRECTIVE ACTIONS	40
6.1 Managing Uncertainty	40
7 EMERGENCY CONTACTS AND PROCEDURES.....	41
8 MONITORING AND REPORTING	42
8.1 Annual Monitoring of Habitat and Effectiveness of Management actions	42
8.2 Detailed Vegetation Monitoring (Years 1-4, 6, 8 and 10).....	42
8.3 Golden Sun Moth population monitoring (Years 1-4, 6, 8 and 10)	43
8.4 Reporting	43
REFERENCES.....	45
FIGURES	47
Appendix 1. Risk Assessment and Management Definitions.....	48
Appendix 2. EPBC OFFSET CALCULATOR.....	50
Appendix 3. Offset Site Assessment Report	53

1 INTRODUCTION

1.1 Background

Ecology and Heritage Partners Pty Ltd was engaged by CH2M Beca to prepare an Offset Management Plan (OMP) to compensate for impacts associated with the proposed development for the Parwan to Melton Pipeline, Victoria (EPBC 2018/8260).

A referral for the action was submitted for assessment under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (EPBC 2018/8260). The referral will be assessed under Preliminary Documentation, which requires the proponent to prepare and implement an Offset Management Plan to compensate for the removal of Golden Sun Moth (GSM) habitat.

The intention of this OMP is to detail the ongoing management actions required to protect 26.5 hectares of GSM habitat at a third-party offset site located at Mount Gow, Shelford, Victoria, in order to offset the proposed impacts. The OMP has been written in consultation with the landowner of the Mount Gow offset site (██████████) and management will be implemented by the landowner.

The OMP is both strategic and focused on management actions and performance measures (quantitative amounts indicated, where appropriate) in order to address management issues and key threats across the offset site.

2 OBJECTIVES AND CONTEXT OF THE PROJECT

2.1 Impact Site

The impact site (study area) for the proposed Parwan to Melton recycled water pipeline is located mostly within private property south of Nerowie Road and is bounded by Parwan South Road (west) and Butlers Road, approximately 60 kilometres north west of Melbourne's CBD. The impact site is long and linear and comprises the road reserve of Nerowie Road and intersects Bucklers Road, Green Hill Road, and Eynesbury Road in Eynesbury (from west-east).

At the time that the EPBC referral (2018/8260) was lodged in August 2018, two alignments were considered: a preferred and alternative alignment. The confirmed study area is the preferred (or southern) alignment, which is approximately 13 kilometres long, with a construction footprint of 35 hectares. The study area is comprised of road reserves and agricultural land used mostly for grazing and some cropping, which is generally flat until it intersects the Werribee River. Patches of native vegetation identified along the length of the pipeline are interspersed with Chilean Needle-grass *Nasella neesiana*, a preferred food plant of the GSM.

According to the Department of Environment, Land, Water and Planning (DELWP) Native Vegetation Information Management (NVIM) Tool (DELWP 2020a), the study area occurs within the Victorian Volcanic Plain bioregion. It is located within the jurisdiction of the Corangamite Catchment Management Authority (CMA) and transects between the Melton Shire Council and Moorabool Shire Council municipalities. Relevant Melton Planning Scheme overlays which apply to the study area are the Design and Development Overlay – Schedule 2 (DDO2), Environmental Significance Overlay – Schedule 1 (ESO1) and 4 (ESO4). The Green Wedge Zone (GWZ) also applies to the study area.

The proposed action at the impact site will have a direct impact on 10.357 hectares of Golden Sun Moth habitat and 4.961 hectares of NTGVVP. The objectives of this OMP are to offset the loss of Golden Sun Moth habitat. Golden Sun Moth is listed as Critically Endangered under the EPBC Act.

2.2 Offset Site

2.2.1 Description of the Offset Site

The third-party offset site (offset site) is located at a private property in Mount Gow, Shelford, Victoria, approximately 63 aerial kilometres south-west of the impact site in Parwan, Victoria (Appendix 3). The offset site will protect 26.5 hectares of GSM habitat and is part of a larger property intersected by Warrambine Creek and abutting 35 kilometres of Mount Gow Road. All identified GSM habitat within the property is proposed to be managed for offset and conservation purposes.

The property contains a northern and southern area which contain patches of NTGVVP and GSM habitat and were initially mapped in 2015 by AECOM, with the remaining areas comprised of moderate quality Plains Grassland interspersed with introduced vegetation (AECOM 2015). The current extent of NTGVVP and GSM habitat was verified in January and February 2020 and during the 2019/20 flying season, respectively (Ecology and Heritage Partners 2020a, Appendix 3). GSM were recorded in the northern half of the offset area, with numbers having increased substantially since the AECOM 2015/16 surveys, with 50+ GSM recorded in the 2019/20 survey season and only five recorded in the 2015/16 season.

The GSM habitat outlined in this OMP will be protected on-title through a Section 173 Agreement under the *Planning and Environment Act 1987* as an interim mechanism, and a Trust for Nature covenant under the *Victorian Conservation Trust Act 1972* in perpetuity for the area covered by this OMP, with the management actions specified within the Section 173 Agreement alike to those specified within this OMP specific to GSM. The offset site selected is part of a larger patch intersected by Warrambine Creek in the northern area, which comprises the required 26.5 hectares of GSM habitat (Ecology and Heritage Partners 2020a, Appendix 3).

According to the Department of Environment, Water, Land and Planning (DEWLP) Native Vegetation Information Management Tool (NVIM) (DEWLP 2020), the offset site occurs within the Victorian Volcanic Plain Bioregion. It is located within the jurisdiction of the Corangamite Catchment Management Authority (CMA) and the Golden Plains Shire municipality.

2.2.2 Tenure Arrangements

The proposed offset site is privately owned by [REDACTED] and is currently in the process of being protected through a Section 173 Agreement under the *Planning and Environment Act 1987*. Further, the offset site will be protected via a Trust for Nature conservation covenant within 24 months of the EPBC Act referral (2018/8260) approval being granted. Once the Trust for Nature Covenant is secured on title, it is proposed that the Section 173 Agreement will be removed.

2.2.3 Environmental Condition and Values

The offset site contains a population of GSM, which reside within the areas of NTGVVP and the surrounding patches of Plains Grassland. This OMP will focus on the protection of one matter of NES relevant to the proposed action (GSM).

3 RISK ASSESSMENT

An assessment of potential risks associated with the objectives of this plan are outlined within Table 1. All risks are considered manageable and actions within subsequent sections of this OMP address relevant risks.

Table 1. Risk assessment and management table for specific offset site for GSM (Appendix 1).

Management objective/desired outcome	Event or circumstance	Relevant management actions/measures	Residual risk			Trigger detection and monitoring activity/ies	Feasible/effective corrective actions	Notes
			L	C	RR			
To legally secure approved offset properties for conservation.	Failure to legally secure approved offset site	Engage with expert offset brokers	Unlikely	Moderate	Low	n/a	Engage a consultant	Low risk: the site is currently in the process of being secured with an on-title agreement (Section 173 Agreement). Further, the site will be secured via a Trust for Nature covenant within 24 months post approval of the referral.
	Legislative reform prejudices proposed tenure arrangements for offset properties.	Monitor DAWE, DEWLP LGAs and other legislative bodies on developments to offsets	Rare	High	Low	Newsletters, expert liaison, press releases and direct contact.	Adjust offset calculations accordingly.	

Management objective/desired outcome	Event or circumstance	Relevant management actions/measures	Residual risk			Trigger detection and monitoring activity/ies	Feasible/effective corrective actions	Notes
			L	C	RR			
To achieve performance targets and completion criteria for all MNES	Landowner-proponent agreements fail to adequately address management commitments in the offset plan	Engage an expert to manage this process. Ensure all impacts are suitably offset.	Unlikely	High	Medium	Quality assurance and monitoring	Revise on-title and/or proponent agreements.	The site will be protected through a Section 173 Agreement. The Section 173 Agreement will be placed on-title and therefore undergo a further review by the Titles Office. Further, the site will be secured via a Trust for Nature covenant within 24 months post approval of the referral.
To achieve performance targets and completion criteria for all MNES	Adjacent/regional landowner's land management practices fail to support attainment of offset outcomes.	Liaise with adjacent landholders. Ensure understanding of offset objectives	Unlikely	High	Medium	Adjacent land practices begin to negatively impact offset site.	Take steps to halt negative impacts. Follow up with stakeholder discussions	The adjacent land parcels contain agricultural land (grazing and/or cropping). Based on the current land management practices in the region and it is unlikely that any foreseeable land management practices within the vicinity will impact the offset site.
To achieve performance targets and completion criteria for all MNES	Insufficient funds provided by proponent to implement the plan.	Ensure reputable land holder to implement plan.	Unlikely	High	Medium	Monitoring and/or annual reporting	Review plan for cost efficiencies.	The offset funds provided by the proponent will be deposited to the land holder. The landholder

Management objective/desired outcome	Event or circumstance	Relevant management actions/measures	Residual risk			Trigger detection and monitoring activity/ies	Feasible/effective corrective actions	Notes
			L	C	RR			
To achieve performance targets and completion criteria for all MNES	Stochastic events (wildfire/drought/flood) prejudice attainment of interim performance targets and/or completion criteria for MNES.	Ensure appropriate biomass management. Plan for scheduling delays.	Possible	High	Medium	Monitoring and/or annual reporting	Apply adaptive management to ensure the objectives of the OMP are not compromised.	-
	Approved development on/near project/offset prejudicing plan outcomes	Ensure proper stakeholder engagement to prevent poor outcomes.	Unlikely	High	Medium	Advertisement of planning scheme amendments/planning permit applications	Objection to proposed development/laisse with proponent to ensure the proposed development does not compromise the objectives of the OMP.	The offset site is within a semi-rural agricultural landscape, as such, there is a low likelihood of development within adjacent properties. The ecological values within the offset site do not rely on habitat values within adjacent land.
	Drought	Apply adaptive management to ensure the site is not over-grazed	Likely	Moderate	Medium	Drought Event	Apply adaptive management to ensure the site is not over-grazed	The offset site sits within 125 hectares of similar quality grassland within the property and is contiguous with native vegetation along Stony Creek and Warrambine Creek in neighbouring properties. The offset site and adjacent areas
	Wildfire		Likely	Moderate	Medium	Wildfire Event		

Management objective/desired outcome	Event or circumstance	Relevant management actions/measures	Residual risk			Trigger detection and monitoring activity/ies	Feasible/effective corrective actions	Notes
			L	C	RR			
GSM habitat improved								have been historically subject to frequent drought and occasional wildfire. As such, the GSM population is likely to survive such an event.
	Uncontrolled grazing	Maintain fences and install temporary fencing, if required (Section 5.5.3.1)	Highly Likely	Moderate	Unlikely	Continual monitoring	Repair permanent fences, and/or install temporary exclusion fences.	The strategic grazing regimes specified within this plan aim to shift species dominance to favour native species abundance and diversity, improving the ecological condition and habitat.
		Exclude stock during (October-November) (see Section 5.5.6 for further information on exclusion period)						
	High biomass levels preventing establishment of native herbs (see Section 5.5.6.4 for performance indicators)	Undertake pulse grazing (Section 5.5.6.2)	Highly Likely	Moderate	Possible	Annual monitoring	Apply pulse grazing in appropriate season to reduce biomass levels (Section 5.5.6.2)	Further, strategic grazing strategies will improve and maintain recruitment space required for native plants to establish, further improving species diversity over time.
Grazing excluded between October-November annually, in perpetuity (Section 5.5.6.2)								
Loss of biodiversity due to competition with weeds (see	Spot spraying of weeds (Section 5.5.4.2)	Likely	Moderate	Possible	Annual monitoring	Undertake weed control activities (Section 5.5.4.2)	The Offset Management Plan includes actions to reduce weed cover, improving the ecological	

Management objective/desired outcome	Event or circumstance	Relevant management actions/measures	Residual risk			Trigger detection and monitoring activity/ies	Feasible/effective corrective actions	Notes
			L	C	RR			
	Section 5.5.4.3 for performance indicators)	Undertake pulse grazing (Section 5.5.4.2)						condition of the site over the 10 year period.
		Annual monitoring to adapt future control works and targets (Section 5.5.4.2)						
	Loss of biodiversity due to pest animal activity (see Section 5.5.5.3 for performance indicators)	Rabbit warrens or fox dens are controlled (Section 5.5.5.2)	Likely	Moderate	Possible	Annual monitoring	Undertake pest control activities (Section 5.5.5.2)	The Offset Management Plan includes actions to reduce pest animal activity, thereby reducing grazing/soil disturbance by the European Rabbit. As a result, the GSM population is likely to improve and expand within the site as it is managed.

Notes. L = Likelihood; C = Consequence; RR = Residual Risk

4 UNAVOIDABLE LOSS AND OFFSET OBLIGATIONS

4.1 Unavoidable Loss

The proposed development at the impact site (Parwan to Melton Pipeline) will result in the removal of the following Matters of National Environmental Significance (NES):

- 10.357 hectares of Golden Sun Moth;
- 4.961 hectares of *Natural Temperate Grassland of the Victorian Volcanic Plain*, and;
- 0.266 hectares of Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia

4.2 Offset obligations, user inputs and applying the offset guide

4.2.1 Golden Sun Moth

Based on the EPBC Act offset calculator (DSEWPaC 2012b), the protection and management of 26.5 hectares of GSM habitat, with the proposed offset site as an offset, mitigates 100.19% of the impact to remove 5.26 hectares of GSM habitat (Table 2; Appendix 2). As such, 100% of the offset requirements will be met through direct offsets and are considered to be in accordance with the Commonwealth environmental offset policy (DSEWPaC 2012a).

Table 2 EPBC Act Offset Calculator (Golden Sun Moth) for Mount Gow Offset site

Offset Criteria	Response
Impact Site	
Impact Location	Parwan to Melton Pipeline: south of Nerowie Road, Parwan, VIC
Habitat to be removed	5.26 hectares of Golden Sun Moth habitat (GSM)
Habitat quality	5/10. A total of 991 moths were recorded during the 2016/17 flight season. However, the majority of moths were recorded along the alternative alignment, which will no longer be impacted. The GSM habitat within the impact area is also dominated by Chilean Needle-grass <i>Nassella neesiana</i> , which is a noxious weed. Therefore, the habitat quality at the impact area is of moderate quality (DSEWPaC 2012b).
Offset Site	
Offset location	Mount Gow, Victoria
Risk-related time horizon	20 years. The land will be managed in perpetuity for conservation purposes for Golden Sun Moth.
Time until ecological benefit	10 years. The existing habitat condition is expected to be improved over the 10-year active management schedule detailed in the Offset Management Plan.

Offset Criteria	Response
<p>Start area and quality of offset site</p>	<p>26.5 hectares in total, of this 20.5 hectares has an assigned start quality of 5/10. This area is located in the northern half of the offset site, where a higher number of GSM were recorded, and a lower cover of exotic grass was present. Within the 20.5-hectare area includes 3.45 hectares of NTGVVP. The remaining six hectares has a start quality of 4/10, due to the higher cover of exotic grass and lower number of GSM recorded.</p> <p>The offset site was assessed by AECOM during the GSM flight season 2014/15 (AECOM 2015) and again by Ecology and Heritage Partners in the 2019/2020 flight season (Appendix 3). The GSM habitat surveyed previously was of low-moderate quality, with four moths recorded at Warrambine Creek and one moth recorded along Mount Gow Road during the 2014/15 flight season (AECOM 2015). In 2019, GSM abundance had increased to 50+ individuals in the northern area and GSM habitat is considered to be of moderate quality (Ecology and Heritage Partners 2020a). The patch of GSM habitat selected for the offset site is located in the northern area along Warrambine Creek and the habitat quality is based on (DSEWPaC 2012b):</p> <ul style="list-style-type: none"> • Site condition: 4-5/10. The site supports a diversity of native grasses, including key grass species associated with Golden Sun Moth (Wallaby-grass <i>Rytidosperma</i> spp., Spear-grass <i>Austrostipa</i> spp.) with at least 25% cover of native grass; The starting site condition was assessed through a Vegetation Quality Assessment (VQA) using the habitat hectare assessment method. The key areas which contribute to these scores are understory diversity, weed cover and recruitment. The VQA score for site condition of the moderate quality areas was 26/75, with an understory score of 10/25, weed score of 2/15 and recruitment score of 3/10. Whilst the understory did have a number of lifeforms present, the diversity and cover of species within each lifeform was lower than the EVC benchmark diversity and cover. Further, the presence of exotic grasses, primarily Toowoomba Canary-grass, negatively impacted both the weed and recruitment score. • Site context: 8/10. Based on a review of aerial photography, predictive mapping of native vegetation extent, and knowledge of Golden Sun Moth populations and habitat in the region, the site is likely to form part of a larger habitat corridor which follows Warrambine Creek, where a population of over 100 has been recorded north of the current proposed offset site (EPBC 2018/8167). The Victorian Biodiversity Atlas has multiple records of Golden Sun Moth scattered within 10-kilometres of the study area, indicating that other suitable habitat exists within the broader region, and the population within the offset site is not an isolated population. Threats that occur to the population within and adjacent to the offset site include the loss of suitable habitat through land clearance (cropping) or disturbance (heavy grazing/slashing). • Species 'stocking rate' (population density): 4/10. A small population of Golden Sun Moth was initially recorded within the offset site (+4 individuals) (AECOM 2015). The recent 2019 surveys recorded higher numbers of GSM within the proposed offset area (Ecology and Heritage Partners 2020a, Appendix 3), with 50+ individuals recorded (Figure 1) which has increased the species stocking rate from a median 3/10 (AECOM 2015) to 4/10. <p>The habitat at the offset site is of moderate quality for GSM. This is due to a native vegetation cover of at least 20% including key food resources (Wallaby-grass, Spear-grass) present within the offset area. The habitat is not considered of high quality, due to the relatively high cover of Phalaris (between 25-40% in NTGVVP patches where GSM are recorded), which is not a key food plant for GSM and therefore reduces the quality of the available habitat at the offset site. The definition of suitable GSM habitat has been based on information provided in the species conservation advice and related documents (i.e. SPRAT (DoE 2019), Approved Conservation Advice (DAWE 2013). The combination of habitat factors presented has resulted in the starting quality of GSM habitat being</p>

Offset Criteria	Response
	<p>assessed at 5/10 for the northern 20 hectares, and 4/10 for a six hectare area directly below the 20.5 hectare patch.</p>
<p>Risk of loss without offset</p>	<p>5%. There are currently no formal protection mechanisms that protect the ecological values present within the offset site. Without protection and ongoing management as an offset site, there is a degree of uncertainty regarding the future condition of the land.</p> <p>As the broader offset property is zoned Farming Zone (FZ), there is a risk that the Golden Sun Moth will be lost by intensified agricultural use (e.g. cropping or intensified grazing). Inappropriate grazing regimes by hard-hooved livestock at higher stocking densities will result in compaction of the soil, which negatively impacts Golden Sun Moth. Intensive agricultural activities such as ploughing, sowing pasture grasses, fertiliser application and/or tilling the soil is likely to result in complete loss of the Golden Sun Moth population. The risk posed by intensification of agricultural use is evidenced by cropping activities in properties surrounding the offset site, which are not adjacent to Warrambine Creek. A protective covenant provides legal protection, averting this risk of losing the Golden Sun Moth community within the site.</p>
<p>Future quality without offset</p>	<p>3-4/10. Without protection as an offset site there is uncertainty regarding the future condition of the land. Without increased management as an offset, a reduction in quality over time is likely due to continued pest and weed encroachment from adjoining properties, as well as perennial weeds that exist elsewhere within the broader property, as well as a lack of land management, including biomass management resulting in a reduction in species diversity.</p> <p>Relatively small areas within the site have a high cover (40%) of the weed Phalaris, which is a fast-growing species that can quickly outcompete native grass species such as Wallaby-grass and Spear-grass. Without increased management, this weed is likely to displace plants that constitute important food resources for the Golden Sun Moth.</p> <p>Without strategically designed grazing strategies, stock can overgraze/undergraze Golden Sun Moth habitat, leading to a shift in introduced species dominance and/or, soil compaction, which reduces the viability of the offset site to support Golden Sun Moth.</p> <p>Rabbits were recorded within and nearby the offset site. Without increased management, rabbits are likely to prevent the recruitment of host plants, leading to a decline in the Golden Sun Moth community.</p>
<p>Risk of loss with offset</p>	<p>1%. There is a 1% chance that the GSM population will be lost with the offset being protected and managed in accordance with the OMP placed on-title. There is a low level of risk given the evidence of recent voluntary conservation works (weed control targeting GSM known habitat) within the site, these works have proved to be successful, demonstrating the landholder's capability in managing threats. Further, the availability of GSM habitat adjacent to the offset site further consolidates habitat within the property.</p>
<p>Future quality with offset</p>	<p>6/10. There is a high level of confidence that the future quality of the Golden Sun Moth offset site within both quality patches will increase through the active implementation of the various actions outlined in the Offset Management Plan. there is a high likelihood that the management actions provided in the Offset Management Plan will lead to an increase in the species' habitat quality, site occupancy and population size. The management actions outlined in this Plan are well known and proven, and therefore there is a high likelihood that the quality of the habitat will improve in the future (DEWHA 2009a, 2009b).</p> <p>The smaller six- hectare patch is believed to be able to achieve a two-point increase, due to the connectivity to the surrounding areas of better quality, small size and through the implementation of the management actions over the 10 year management period. Currently, the exotic vegetation</p>

Offset Criteria	Response
	<p>cover is estimated at up to 40% cover in the moderate quality patches of habitat (which correspond with all areas not recorded as NTGVVP within the offset area). It is expected that at the end of the 10-year management period the exotic vegetation cover will not exceed 30%, Further, this will be measured through a demonstrated increase in the VQA site condition score, primarily in the areas of moderate quality Golden Sun Moth habitat. This area currently contains a higher biomass and weed cover, resulting in a recruitment score of 3/10 and a weed score of 2/15, as detailed in the site assessment report (Ecology and Heritage Partners 2020a). It is expected that at the end of the 10-year management of the site, the weed score will have improved to at least a 6/15, and the recruitment score to a 6/10. The weed and recruitment score will improve through the management of exotic grasses, where biomass will be monitored to ensure adequate inter-tussock spacing, and targeted control of Toowoomba Canary-grass will be undertaken. The targeted control of Toowoomba Canary-grass will provide opportunity for native grass and herb recruitment, increasing the cover of native species and ultimately improving the understory score to a minimum of 15/25. Further detailed on weed control actions are detailed in Section 5.5.4.</p> <p>Due to the commitment of the current landowner and investment in the active management of the site these factors provide a high level of confidence that the future quality of the offset will increase (i.e. a score of six is realistic). This is supported by the increase in GSM stocking density since 2015 (AECOM), where recent surveys (2019 flying season) recorded 50+ GSM flying at the northern area of the proposed offset site. Previously, AECOM (2015) recorded <5 GSM at the same location. This suggests that current management practices (e.g. slashing phalaris) have been successful in improving habitat and providing inter-tussock space for Golden Sun Moth. Further, management actions and targets as detailed in this OMP will achieve the end result of the entire 26.5 hectare area being of similar high quality for GSM. Management actions within the six-hectare area will be focused on reducing the cover of Toowoomba Canary-grass and improving the cover and abundance of key native habitat plants for GSM, primarily Wallaby-grass and Spear-grass. The presence of Toowoomba Canary-grass was the driving factor in the reduction in quality, with other key threats, such as change in land use, soil compaction, additional weed invasion and inappropriate fire regimes all managed within this OMP. Given that Toowoomba Canary-grass is the main item causing a reduction in habitat quality for GSM, it is the belief that this six hectare area will be improved to demonstrate a two point difference between starting condition (with respect to stocking density and site condition improvement) and future condition over the course of the 10 year management plan.</p> <p>The offset site is to be secured and managed for conservation purposes in perpetuity, with implementation of a management plan incorporating weed control, biomass control and regular monitoring, aiming to enhance native biodiversity.</p> <p>The species was previously observed in grassland areas with at least 20% native grass cover (wallaby-grass <i>Rytidosperma</i> spp., spear-grass <i>Austrostipa</i> spp.) and weed management is necessary to ensure that native grass cover is maintained.</p> <p>Appropriate livestock grazing management is necessary to ensure that soil compaction is minimised and native grasses are not overgrazed. Low density grazing can be beneficial for maintaining GSM habitat.</p> <p>Pest management is required to ensure rabbit populations are managed and numbers are reduced to prevent over-grazing.</p>
<p>Confidence in result</p>	<p>80-90%. Confidence in applied scores is relatively high due to careful consideration of the offset site, existing condition and evidence of the landholder’s capability to manage threats through recent conservation works. The site will be protected through a Section 173 Agreement under the <i>Planning and Environment Act 1987</i> with Council. Council undertakes a quality assurance process</p>

Offset Criteria	Response
	<p>for all offset sites to ensure the landowner agreements address the management commitments in the plan.</p> <p>Further, the site will be secured via a Trust for Nature covenant under the <i>Victorian Conservation Trust Act 1972</i> within 24 months post approval of the referral.</p>
% of impact offset off-site	<p>20.5 hectare high quality area: 73.60%</p> <p>Six hectare moderate quality area: 26.59%</p> <p>Total: 100.19%</p>

5 OFFSET IMPLEMENTATION

5.1 Management Objectives and Strategy

The offset site will be managed for the purposes of conservation and will involve physical protection of the GSM habitat, the control of pest animals and environmental weeds, biomass reduction and general maintenance of the character and quality of the native vegetation, consistent with its historic context.

The offset site will be protected in perpetuity via a Section 173 Agreement (Table 4) and a Trust for Nature Covenant. The Section 173 agreement will be an interim mechanism until the Trust for nature covenant is placed on title (within 24 months of the EPBC Act approval for the project). This OMP will be attached to the on-title agreement and require the landowner to manage the offset site in accordance with the requirements detailed herein. Security, management and monitoring responsibilities are summarised in Table 5. This OMP relates solely to the 26.5 hectares of GSM habitat and includes actions related to the ongoing monitoring and management of the ecological communities.

Table 4. Security and Management Responsibility

Offset Security and Management Responsibility	Parwan to Melton Pipeline
Who is liable/responsible for meeting offset requirements?	Western Water
Type of security mechanism	Interim: Section 173 agreement Future: Trust for Nature Covenant
Agreement or Planning Permit Number (ID)	TBC/2020 EPBC 2018/8260
Date 10-year offset management to commence	Upon approval of this OMP by DAWE
Date 10-year offset management expires	10 years following approval of this OMP by DAWE
Offset site management responsibility (i.e. Landowner, Authority Name)	██████████
Offset Monitoring Responsibility (i.e. Responsible Authority)	Landowner, Western Water, DAWE, TfN

5.2 Compliance with Offset Principles

The 'Environmental Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy' (DSEWPaC 2012a) outlines a set of principles that a proposed offset must meet in order to be assessed under the referral process. These principles are detailed in Section 7 of the Preliminary Documentation (Ecology and Heritage Partners 2020b), along with how the proposed offset site meets these requirements.

5.3 Offset Targets

The EPBC Act offsets policy (DSEWPaC 2012a) provides the details of the offsetting approach for Matters of NES; this includes an Offset Assessment Guide and offset calculator.

The Offset Assessment Guide offset calculator has been completed to determine the area of offset required to adequately compensate for the removal of GSM habitat at the development site. The Offset Assessment Guide offset calculator is provided in Appendix 2, and a justification for the scores given in Section 4.2.

5.4 Ongoing Land-use Commitments

The offset site will be managed to ensure the quality of remnant native vegetation and habitat for Matters of NES is improved over 10 years. After this period of management, the land will be required to be maintained in the condition achieved as a result of that management, in perpetuity.

From the commencement of the agreement, the Landowner agrees to undertake the following long-term (ongoing) management commitments in perpetuity for the 26.5 hectares of GSM habitat:

- Retain and manage all native vegetation as directed by this OMP;
- Exclude domestic stock, except as permitted by this OMP;
- Eliminate all woody weeds < 1 % cover;
- Ensure that weed cover does not increase beyond the current level;
- Monitor for any new and emerging weeds and eliminate to < 1% cover;
- Control rabbits; and,
- Undertake biomass management (grazing).

5.5 Management Actions

Implementation of the management actions (excluding third party monitoring) outlined within this OMP is the responsibility of the landowners (██████████), as detailed in the MoU prepared between Western Water and the landowner, however, direct management responsibility may be delegated to a designated site manager and/or managing ecologist with annual reports submitted to Council, Trust for Nature, DAWE and the Proponent (Western Water). Specific monitoring and reporting requirements are detailed in Section 8.

Management actions detailed in this OMP will commence from the date the offset site is secured on title (i.e. registration of the Section 173 Agreement). A breakdown of management actions required over the mandatory 10-year active management period is shown below (Table 10). Following the 10-year active management period, the landowner will continue to manage the offset site as specified in this plan, such that:

- By Year 10 of management, the weed cover must be reduced from levels upon inception of this plan (Section 5.5.4). Following Year 10 of this plan, the weeds within the site must be maintained at the improved state achieved at year 10, or ideally improved further;
- GSM habitat is improved through an improvement in site condition and at minimum, maintaining the current stocking rates, and;

Funding for undertaking security, management and monitoring actions prescribed in this OMP has been agreed between the landowner (██████████) and the Proponent (Western Water), in accordance with the signed Memorandum of Understanding (MoU) between both parties.

Any proposed uses or development of the offset site which conflict with the landowner's commitments are not permitted under this plan. The sensitivities of the offset site must be considered with all management actions and all contractors entering the offset site need to be made aware of its ecological values.

The management and monitoring actions detailed in this OMP have been development in accordance with the following legislations and/or policies:

- *Environment Protection and Biodiversity Conservation Act 1999*;
- *Flora and Fauna Guarantee Act 1988* (FFG Act);
- *Catchment and Land Protection Act 1994* (CaLP Act);
- Commonwealth's Threat abatement plan for competition and land degradation by rabbits (DAWE 2016);
- Commonwealth's Threat Abatement Plan for predation, habitat degradation, competition and disease transmission by feral pigs (DAWE 2017);
- Significant impact guidelines for the critically endangered Golden Sun Moth (*Synemon plana*). Department of the Environment, Water, Heritage and the Arts (DEWHA 2009a); and,
- Approved Conservation Advice for *Synemon plana* (golden sun moth). Canberra: Department of the Environment. Department of Environment (DoE 2013).

Of note, weed invasion and inappropriate grazing regimes are two of the main demonstrated threats to GSM populations due to the potential to alter habitat quality.

This OMP addresses these demonstrated threats by including management actions aimed at reducing the likelihood of weed invasion, the preparation of an appropriate grazing regime sensitive to the values that exist in the offset site and surrounds.

5.5.1 Golden Sun Moth

This management plan has been formulated to address several priority actions outlined within the Conservation Advice for the species (DoE 2013):

- Investigate formal conservation arrangements, management agreements and covenants on private land, and for crown and private land investigate and/or secure inclusion in reserve tenure if possible;
- Retain and protect natural grassland remnants within the known distribution of the species;
- Monitor known populations to determine the species' status;
- Monitor the progress of recovery, including the effectiveness of management actions and the need to adapt them if necessary;
- Identify populations of high conservation priority;
- Control invasions of weeds and pasture species, and consider the impact of herbicide use in habitat; where possible use methods that directly target weeds such as spot spraying and hand removal to minimise the adverse impact on GSM;

- Re-introducing an appropriate control method where Kangaroo Grass (*Themeda* spp.) threatens to out-compete wallaby grasses in previously grazed or mown sites;
- Manage the amount of grazing to minimise any direct adverse effects on GSM or its habitat. The management regime should include some focus on grazing and fire, as combining the two in the wrong way (e.g. heavy grazing soon after a fire) is particularly damaging to perennials; and
- Engage with private landholders and land managers responsible for the land on which populations occur and encourage these key stakeholders to contribute to the implementation of conservation management actions

5.5.1.1 Existing Threats

The main threats to the offset site include the existing permitted uses associated with normal farming practices, such as inappropriate grazing regimes, pasture improvement and fertiliser application. Other threats include the expansion of the existing high threat weed populations that are present within the surrounding area, weed invasion in general and the accumulation of ground cover biomass. High threat weeds are defined as those introduced species (including non-indigenous natives) with the ability to outcompete and substantially reduce one or more indigenous life forms in the longer terms assuming on-going current site characteristics and disturbance regime.

This OMP details the prescribed actions and outlines the relevant timing for implementation. These actions will be applied to the entire offset area identified in Figure 1.

Maintenance and protection of the offset site will be achieved by:

- Stock-proof fencing around the boundary of the offset site;
- Weed control through active management;
 - Eliminating all woody environmental weeds to < 1% cover;
 - Reducing cover of exotic grass to <30% cover;
 - Controlling all herbaceous weeds to reduce cover;
- Biomass control through high intensity pulse grazing of domestic stock (sheep only) with stock generally excluded from 1st October to 31st January;
- Controlling pest animals, particularly rabbits and foxes; and,
- Managing native species understorey diversity and recruitment.

5.5.1.2 Threats specific to Golden Sun Moth

Table 5 below outlines the key threats to Golden Sun Moth, as identified in the Significant Impact Guidelines for the species (DEWHA 2009) and addresses the management action that will be applied to the offset site to mitigate the threat. Further details regarding each mitigation measure are provided in Section 5.5.2 to Section 5.5.7, and a table of recommended management actions for each year in Section 5.6.

Table 5. Key threats to Golden Sun Moth

Key threat to GSM (DEWHA 2009)	Mitigation measure
Removal of vegetation	Habitat for Golden Sun Moth within the offset site will be protected by fencing (Section 5.5.2) and will be protected through a Section 173 Agreement and a Trust for Nature Covenant. Without this protection, the site may be used for cropping purposes or cleared for other reasons.
Inappropriate fire regimes	<p>Ensure biomass is maintained at low levels to reduce fuel loads across the site (Section 5.5.5). In addition, a number of wildfires have occurred in the past at the offset site, which have not had a significant impact on Golden Sun Moth due to their current population numbers remaining high.</p> <p>The biomass level monitoring will aid in the prevention of a damaging wildfire through fuel reduction management.</p>
Weed invasion	<p>One main weed, Toowoomba Canary-grass, poses a threat of invasion and reducing the native grasses present within the offset site. Toowoomba Canary-grass, along with other key weed species including the declared noxious weed Serrated Tussock <i>Nassella neesiana</i>, will be prioritised for control, with target levels set to be achieved within the 10-year management plan (Section 5.5.3). The control of Serrated Tussock will increase the area available for native grass recruitment and maintain the open tussock structure.</p> <p>Without the control of Toowoomba Canary-grass, it is likely the species would dominate the site, and reduce the habitat available to Golden Sun Moth. Therefore, efforts will be focused on reducing the cover of Toowoomba Canary-grass across the offset area, with a particular focus on the southern portion of the offset site where the six hectare area of moderate quality GSM habitat is located. This area contains a higher cover of Toowoomba Canary-grass, where reduction would see an opening in inter-tussock spaces and allow native grasses to regenerate. If it is found native grasses do not naturally regenerate, more intensive measures should be investigated, such as spreading local native grass seed into the area to boost recruitment and prevent further invasion from Toowoomba Canary-grass.</p>
Overstocking (causing loss of habitat plants, changes to soil and plant structure or increase nutrient load)	<p>Fencing will be maintained around the offset site, to ensure livestock grazing is managed within the offset site. When grazing is permitted, numbers will be monitored to ensure biomass levels and native grasses are not heavily impacted, and that the grazing does not impact upon plant structure within the offset site. If negative impacts from grazing are observed, livestock will be removed (Section 5.5.5).</p> <p>Without grazing control, the site may experience overgrazing where native species are damaged and inappropriate grazing occurs (i.e. late spring) affecting the seed distribution and regeneration of the native grassland, and ultimately reducing the amount of available Golden Sun Moth habitat.</p>
Changes to agricultural practices (e.g. ploughing, overgrazing)	<p>The offset site will be fenced and protected through a Section 173 Agreement and a Trust for Nature covenant. The landholder will commit to managing the site for conservation and will not engage in cropping within areas set aside for the offset. Grazing will be permitted with conditions, such as not during wet periods or when biomass levels are low.</p> <p>The protection of the offset site will lock the land up for conservation, which does not permit ploughing, and limits grazing. Without this protection, the site is at risk to either threat.</p>

Key threat to GSM (DEWHA 2009)	Mitigation measure
Rank growth (loss of inter-tussock spaces)	Loss of inter-tussock space may occur if Toowoomba Canary-grass and noxious weeds Serrated Tussock-grass is not controlled and biomass across the offset site is not managed. Management of Serrated Tussock is included in the management actions, with specific control methods and targets set for the species (5.5.3). General biomass will be managed through pulse grazing (Section 5.5.5).
Soil compaction	Soil compaction will be monitoring during and after grazing events. If soil compaction is evident, then grazing numbers will be reduced. This will be monitored in conjunction with the biomass control (Section 5.5.5)

5.5.2 Fencing and Access

An existing permanent stock-proof fence currently exists around the perimeter of the broader offset property. Under this agreement livestock (sheep) may be permitted into the offset site for control of herbaceous/grassy weeds and biomass management, with grazing to be generally excluded between 1st October and 31st January (see Section 5.5.5 for further details on stock exclusion periods).

Permanent fencing around the offset site is not recommended to avoid the need for establishing stock watering points which will displace native vegetation, to avoid the funnelling of stock through internal gates, and to minimise the disturbance to native vegetation along internal fence-lines. Temporary fencing will be erected around the offset site during the grazing exclusion period if livestock are grazed within other areas of the broader property and cannot be contained.

Posts marking the boundary of the offset site will be established to clearly identify the area for monitoring and management purposes.

The offset site and broader property remain private property and access or disturbance to the offset site by unauthorised persons is prohibited. The existing access and security (locked gates) arrangement is adequate to service the access requirements for management of the offset site.

5.5.2.1 Actions

- Maintain existing perimeter fencing and access control to the broader property;
 - If any damage occurs to the existing fencing, repair immediately.
- Erect temporary fencing around the offset site, if livestock are grazed within the broader property during the exclusion period, which generally occurs from 1st October to 31st January and cannot be contained to these areas (see Section 5.5.5 for further details on stock exclusion periods). Note that pulse grazing may be permitted from 1st February to 30th September provided conditions are dry enough, and ground disturbance (pugging) will not occur;
- Establish posts to mark the boundary of the offset site for management and monitoring purposes in accordance with advice from a qualified ecologist and land surveyor;
- Control access and any passive use of the offset site to minimise impacts on native vegetation;

- Provide access for farm owned management vehicles into the offset site, using the existing access gates. No additional vehicle access is to be established without the approval of the landowner, TfN and DAWE.

5.5.2.2 Performance Indicators

- Stock excluded from offset site during relevant exclusion period (generally October-November) (see Section 5.5.5 for further information on exclusion period);
- Access to the offset site is appropriately controlled;
- Existing and temporary fencing is maintained in good repair;
- Posts around the perimeter of the offset site are established for monitoring and management purposes; and,
- All fencing activities and repairs are effectively documented.

5.5.2.3 Adaptive Management

- The location of the temporary fencing may be slightly varied from year to year to minimise the disturbance to native vegetation along internal fence-lines.

5.5.3 Weed Control

5.5.3.1 Objectives

The objective of weed control within the offset site is to improve the existing quality of Golden Sun Moth habitat by reducing/minimising future invasion by exotic flora. This will be achieved through a combination of controlled pulse grazing (to limit opportunities for weed establishment and seed set in exotic flora), and through on-ground management activities.

At the offset site, Golden Sun Moth were recorded in areas that typically had a 25-70% cover of native grasses, mainly Wallaby-grass *Rytidosperma* spp. and Spear-grass *Austrostipa* spp. (Ecology and Heritage Partners 2020a, Appendix 3). Golden Sun Moth are known to occur in areas with a moderate-high weed cover, including the noxious weed Chilean Needle-grass (although not present within the offset site), and measures should be taken to manage non-native habitat without reducing the quality of habitat for GSM.

Woody weeds

A limited number (<5%) of African Boxthorn *Lycium ferrocicimum* were recorded within the offset site. African Boxthorn must be eliminated from the offset area. Monitoring for new and emerging woody weeds will be conducted throughout the year for the term of the agreement, and any new and emerging woody weeds eliminated.

Herbaceous weeds

The aim of management is to reduce cover below current levels. Current herbaceous weed cover within the offset site is estimated to be around 30-75% throughout the offset area, with weed cover higher in the areas not recorded as NTGVVP. Weeds listed in Table 4 were found within offset site. These weeds will be controlled and monitored each year to ensure their cover is reduced, with a VQA weed score of 6/15 achieved by the end

of the 10 year management period. Weeds must be treated using methods listed in Table 6 before the plant has flowered and set seed. Indigenous plants must not be impacted during treatment of weeds.

Annual weeds within the offset site are not considered to be a significant threat and will be managed using grazing to reduce their prominence.

Spot spraying with appropriate herbicide is the main method for reducing weed cover. Spot spraying will be undertaken regularly, particularly in spring and early summer, with a focus on killing weed plants prior to seed set. Spot spraying will be completed in a manner which minimises non-target damage. Spot spraying will not occur during high wind days or in close proximity to threatened flora without protective measures in place (i.e. physical shielding). Biomass control is also considered to be an effective method for controlling and reducing weed levels and will include controlled livestock grazing (sheep).

Weed control methodology for eradicating graminoid and herbaceous weeds will comprise manual removal and/or targeted spot spraying with an appropriate herbicide. Care must be taken when spraying herbicide to ensure that the poison does not affect native vegetation in the local application area. Weed species must be treated before seed is set, which may involve localised slashing if spot-spraying proves ineffective. A dye will be used in the spray to mark where spraying has been utilised.

The composition and distribution of vegetative cover across the offset site is likely to change over time in response to seasonal conditions or pulse grazing. Therefore, weed cover and species will be continually monitored and management activities adapted to ensure the desired outcomes outlined in this OMP are achieved.

New and emerging herbaceous weeds

Monitoring for new and emerging herbaceous weeds will be conducted throughout the year for the term of the agreement, and any new and emerging weeds eliminated (<1% cover) (Table 6).

Any other significant environmental weeds identified within the broader property during monitoring will also be controlled. The landowners may consult with a qualified ecologist regarding appropriate control techniques for any new or emerging weeds identified within the offset area.

Table 6. Herbaceous weeds to be controlled – method and timing

Common name	Scientific name	% total cover at inception	Method	Timing
Sheep Sorrel	<i>Acetosella vulgaris</i>	1%	Pulse-grazing	Generally, early Spring to avoid GSM flying season
Wild Oat	<i>Avena fatua</i>	3%	Pulse-grazing	Generally, early Spring to avoid GSM flying season
Barley-grass	<i>Hordeum</i> spp.	3%	Pulse-grazing	Generally, early Spring to avoid GSM flying season

Common name	Scientific name	% total cover at inception	Method	Timing
Cat's-ear	<i>Hypochaeris radicata</i>	3%	Pulse-grazing and targeted spot spraying with appropriate herbicide.	Generally, early Spring to avoid GSM flying season. Spot-Spray: Spring and early summer
Serrated Tussock	<i>Nassella trichotoma</i>	<1%	Targeted spot spraying with appropriate herbicide.	Spot-Spray: Spring and early summer
Rat-tail Fescue	<i>Vulpia</i> spp.	2%	Hand chip, or targeted spot spraying with appropriate herbicide.	Spot-Spray: Spring and early summer
Toowoomba Canary-grass	<i>Phalaris aquatica</i>	25-40%	Targeted spot spraying with appropriate herbicide. Pulse-grazing.	Spot-Spray: Spring and early summer; Graze: early Spring to avoid GSM flying season
Spear Thistle	<i>Cirsium vulgare</i>	<1%	Hand chip, or targeted spot spraying with appropriate herbicide.	Spot-Spray: Spring and early summer

Spot Spraying

The application of herbicides is an effective and efficient control technique for a range of woody, herbaceous and grass weeds. The correct use and application of herbicides can provide targeted control of a range of species. However, all herbicides must be used in accordance with the manufacturer's specifications and occupational health and safety policies.

Application methods for herbicides include: spot spraying with a knapsack, dabbing of weeds in sensitive areas with a foam-tipped application device, rig spraying with a pump for larger areas, dabbing of cut stumps and injection of woody weeds.

Timing of the interval of spot spraying is dependent upon many factors such as plant age and growth seasons, plant stress levels and climatic factors. All these factors need to be considered when develop methodologies for the application of herbicides to ensure successful outcomes. Surrounding native plants' susceptibility to herbicides and ongoing uses of the treated areas must also be considered when choosing the right herbicide to be used in a weed control program, as some herbicides are residual and may persist within the soil for varying durations.

5.5.3.2 Actions

- Periodic spot spraying of weeds with appropriate herbicide will be undertaken, particularly through spring and early summer as detailed in Table 6;
- Any populations of new and emerging high threat weeds will be treated promptly and eliminated to <1% cover. This will be done in consultation with DAWE;
- During weed control, natural regeneration of indigenous flora will be protected from off-target damage;

- Undertake pulse grazing within the offset site to reduce weed cover as per Section 5.5.5; and
- Annual monitoring will be undertaken to demonstrate the effectiveness of weed control works and the results are to be used to adapt future control works and targets.

5.5.3.3 Performance Indicators

- Eliminate all high threat and woody weeds (<1% cover) within Habitat Zone 1;
- Where herbicide application is employed, waterway sensitive products and non-residual herbicides are to be employed;
- Achieve a VQA weed score of at least 6/15 by the end of the 10 year management period;
- Achieve an understory score of at least 15/25 by the end of the 10 year management period;
- No off-target damage to indigenous plants; and
- No new or high threat weeds establishing within the offset site.

5.5.3.4 Adaptive Management

- Respond to the annual monitoring report and associated recommendations;
- If objectives and performance indicators are not being met:
 - Review grazing regime;
 - Increase frequency of control activities; and
 - Raise any significant issues with DAWE as soon as they arise.

5.5.4 Pest Animals

5.5.4.1 Objectives

The objective of pest animal management is to control pest animals (e.g. rabbits, foxes) within the offset site, as required, to minimise negative impacts to the Plains Grassland and NTGVVP communities, which provides habitat for Golden Sun Moth. The *Catchment and Land Protection Act 1994* lists rabbits and foxes as established pest animals and requires that all landowners take reasonable steps to prevent the spread of, and as far as possible eradicate, established pest animals on their land.

Rabbits will be monitored and controlled throughout the year. Small warrens were recorded within and surrounding the offset site; the size of the population was considered manageable. An integrated approach in accordance with BushBroker Information Sheet 7 - Standards of Management – Rabbits, will be followed which will involve fumigation, hand collapsing of burrows and baiting. Any rabbit carcasses found within the offset site will be removed to prevent poisoning of native predators. These actions are in accordance with the Commonwealth's *Threat abatement plan for competition and land degradation by rabbits* (DAWE 2016).

Ripping of rabbit warrens within the offset site is not permitted. If any warrens develop within the offset site, they will be treated by low impact measures such as fumigation or collapsing.

Foxes are a threat to native fauna and must be controlled if identified within the offset site. If identified, fox dens will be destroyed through fumigation and hand collapse.

To reduce the likelihood of pest animals inhabiting the offset site on a regular basis, any artificial piles of logs and rocks that may be used as harbour by pest animals will be removed or dispersed.

Both rabbits and foxes will be controlled as detailed in Table 7.

Table 7. Pest animals to be controlled – species, method and timing

Common name	Method	Timing
Rabbits	Baiting. When baiting collect and dispose of carcasses to prevent poisoning of native predators.	Ongoing
Rabbits & Foxes	Fumigation and collapse of rabbit burrows and fox dens if identified. Remove or disperse surface harbour.	Ongoing
New & Emerging pest animals	Monitor and control	Ongoing

5.5.4.2 Actions

- Control and seek to locally eliminate pest animals using appropriate control techniques, including poison baits, warren fumigation and collapsing, or similar methods, without soil disturbance; and
- Fumigate rabbit warrens according to best practice management techniques. Fumigation works will be conducted by the landowner or a suitably qualified operator where rabbit activity is identified.

5.5.4.3 Performance Indicators

- Any rabbit warrens or fox dens are controlled immediately following detection;
- Reduction in the abundance of pest animals, and no detectable impacts to the native grassland community; and
- All monitoring and management activities are effectively documented.

5.5.4.4 Adaptive Management

- If pest animal management fails to achieve a reduction, or effectively control rabbit or fox numbers, or if impacts to GSM habitat are attributable to an increase in pest animals activities, a review of the current procedures and management measures will be undertaken;
- Review performance of pest animal contractor;
- Increase active monitoring of pest animal activity;
- Incorporate additional control measures (i.e. spotlighting and shooting); and
- Improve existing fencing of broader offset property to exclude pest fauna.

5.5.5 Biomass Control

5.5.5.1 Objectives

The objective of biomass control within the offset site is to promote and maintain floristic diversity, and inter-tussock spaces for germination and recruitment of native flora associated with the grassland communities. This will also have positive outcomes for managing Golden Sun Moth habitat. In addition, these actions will improve habitat quality for existing flora present within the offset site and assist with minimising the growth of weeds.

Biomass management is essential to enhance the ecological values throughout the offset site, including the maintenance and improvement of GSM habitat. Biomass management is also required to maintain inter-tussock spaces and prevent excessive competition to grassland forbs. Biomass control will aim to maintain approximately 20% to 40% cover of bare ground or inter-tussock space to allow sufficient space for recruitment of herbs and grasses. If the GSM offset area is found to be less than 20% bare ground then biomass reduction must be implemented at the earliest possible opportunity (with consideration of seasonality in order to minimise risk to ecological values, life and assets).

The current biomass reduction method applied throughout the offset site consists of low-intensity rotational grazing. Sheep are removed during the critical flowering/reproductive period for native species (October to January) then sheep are returned to graze between March and September. The current grazing regime and historical land use is not considered to have an adverse impact on the GSM habitat and given that native vegetation has persisted across the property, it is considered an appropriate method for managing biomass.

Pulse Grazing

Livestock grazing is the historical land use at the property and offset site (AECOM 2015). A detailed study has been undertaken on the ecological impacts and benefits various grazing regimes on grasslands within the property, in addition to similar properties (Mavromihalis *et al.* 2013). It was concluded that a period of grazing exclusion may be beneficial for enhancing conservation values of grasslands. Further, exclusion of grazing during spring (September–November) is most beneficial, however, due to seasonal variation in vegetation composition, fixed grazing strategies were considered inappropriate, as they do not allow for temporal fluctuations. For example, in occasional years, excluding grazing during summer, rather than spring, may be beneficial in controlling annual grasses following particularly heavy spring rains; although, grazing during spring every year may lead to a decline in species richness. As such, the grazing regime within this OMP is to generally exclude stock during spring, however, seasonal variation to this period may be required in order to adapt to annual variation in vegetation composition. However, grazing during spring may not occur during more than two consecutive years; this aims to achieve a balance between having sufficient flexibility to respond to seasonal variation in plant growth and mitigating risks associated with spring grazing over extended periods.

Grazing will be undertaken in a controlled manner following the grazing management plan detailed in Table 8, to ensure that biomass accumulation control within the offset site is consistent with the standards for management of ecological grazing provided by DELWP (DSE 2009). Grazing of domestic stock will be restricted to the use of sheep. Grazing by other domestic stock, including, but not restricted to, cattle, goats and horses is prohibited within the offset site at all times.

Grazing will occur over a short duration and exceed the standard stocking rate to prevent selective grazing within the offset site. The maximum length of continuous grazing is four weeks with at least two weeks rest

between cycles. At least three pulse grazing cycles will occur within the grazing period, one of which will occur immediately prior to the exclusion period (weather permitting).

Table 8. Grazing Management Plan within the offset site.

Grazing Requirement	Targets
Period where grazing by domestic stock is not permitted	October-November annually in perpetuity, in addition to times outside this period when standing water is present, or soil is waterlogged. However, if seasonal variation to this period may be required in order to adapt to annual variation in vegetation composition.
Pulse grazing cycles required	3 (minimum)
Minimum rest from grazing between pulse grazing events	2 weeks
Maximum continuous pulse grazing event	4 weeks
Biomass management thresholds	Minimum height of 10 cm; total vegetation cover of no greater than 70%
Target inter-tussock space	Minimum of 30% of total offset site cover.

Stock must be removed should total vegetation cover fall to or below 70%. Stock pens and heavy vehicle traffic must be confined to the areas outside that covered within this OMP. Following any high rainfall events, stock will be removed from the offset site immediately.

5.5.5.2 Actions

- Biomass will be managed by pulse grazing with sheep for a maximum period of four weeks followed by a minimum two-week period of rest;
- In perpetuity, grazing will be excluded annually between October-November; however, on an occasional basis, seasonal variation to this period may be required in order to adapt to annual variation in vegetation composition (Mavromihalis *et al.* 2013). Any grazing between October-November must be documented within reports to DAWE (Section 5.5.6). Grazing must not occur between October-November for more than two consecutive years; and,
- Stock must be excluded at any time when standing water is present, or soil is waterlogged, to mitigate pugging of the soil surface.

5.5.5.3 Performance Indicators

- Maintain or improve species richness and improve species diversity;
- Improve species recruitment through improvement and maintenance of suitable vegetation structure throughout the site; biomass remains moderate (i.e. no increase on current levels), and suitable inter-tussock spaces for natural recruitment maintained/provided (through transect monitoring and photo-points – see below);

- Achieve a VQA understory score of at least 15/25 by the end of the 10 year management period;
- Achieve a VQA recruitment score of at least 6/10 by the end of the 10 year management period;
- Stock grazing is excluded between October-November, except where necessary for further biomass reduction during dry periods. Grazing does not occur between October-November in more than two consecutive years;
- Establishment of 14 x 1m² quadrats throughout the offset site to monitor density of biomass;
- Weed biomass does not increase in areas of remnant vegetation;
- Minimum of 20% of total offset site cover will comprise inter-tussock space; and,
- All grazing events effectively documented.

5.5.5.4 Adaptive Management

Highly seasonal conditions are not uncommon across western Victoria and can result in variable conditions from year to year. This is acknowledged within the OMP by allowing for a flexible approach to the timing of grazing actions at the discretion of the Landowner.

5.5.6 Monitoring and Reporting

This Offset Management Plan requires the approval holder to submit a report annually to DAWE for each year of the 10 Years of this Offset Management Plan and continue monitoring every year following for the life of the project approval under the EPBC Act. The reports will include a review of past management works against the performance targets and objectives contained within this OMP. Future management priorities will also be detailed in these reports.

The Landowner will establish seven permanent photo-points in the GSM habitat offset site. These points will be marked via GPS and shown on a Figure. Photographs taken from these points will be representative of the vegetation and objectives of the OMP (e.g. areas of high threat weed invasion). Photographs will be taken in October each year and clearly labelled. Each photo will be taken from as near to the same point each year and will use the same direction, trajectory and camera settings as is practicable.

Photographs and Annual Reports are to be submitted at least 2 months prior to the anniversary date of the execution of the agreement to allow time for compliance to be assessed before the anniversary date.

The Annual Report addresses progress against the commitments set out in this agreement. Annual Reports must provide enough detail in the form of written comments and supporting evidence that an assessor can easily determine the completion of/progress against the commitments for each zone.

The template for a landowner monitoring and reporting form is shown in Table 9. Information to be provided in the reporting form includes:

- A copy of the Management Action Table from the OMP with information on which actions have been completed for year/s of this reporting period;
- A description of the specific monitoring results from surveys undertaken (i.e. GSM habitat condition assessment);
- Success of weed and pest animal control work;

- Successful management tools (i.e. techniques used to control weed species, protection of new plants, monitoring technique, etc.);
- Any problems or issues experienced (i.e. new infestation of weed species, etc.); and,
- Provide photographs showing evidence of works.

If any agreed management actions or commitments are incomplete or have not been undertaken in the times specified, the landowner is to document the justification and the actions that will be action/s will be undertaken to implement the requirement.

All records/evidence of management actions must be maintained and be submitted to TfN and/or DAWE upon request, and any proposed changes to management must be submitted to TfN and/or DAWE prior to the changes being undertaken.

Table 9. Template for a Landowner Monitoring and Reporting Form

Landowner of offset site	
Location and address of offset site	
Offset site number (if applicable)	
Offset plan reference number (if applicable)	
Responsible Authority	
Report #	
Signature	
Date	
Details of works undertaken	

5.5.7 Offset Management Plan Review

The protection and management of the nominated offset area is for perpetuity. The OMP will be reviewed by a suitably qualified Ecologist, in consultation with the Landowner, five years from the date of approval. The focus of the review will be to determine its effectiveness in managing the GSM habitat.

The 5-year review of the OMP will be submitted to Trust for Nature and DAWE for approval prior to any recommendations regarding management of the offset site being implemented.

5.6 Management Actions Table

Management actions proposed to compensate for the loss of native vegetation and habitat under Commonwealth legislation at the offset site are presented in Table 10. The actions constitute the minimum management requirements for the offset site over the mandatory 10-year management period and are appropriate for the management of the GSM population.

Table 10. Management Actions Table

Year from Commencement	Area	Management Action Description	Timing	Environmental outcome to be achieved
Fencing				
1-10	26.5 ha of GSM habitat	Maintain fencing in good condition around entire boundary of all sites where fencing exists or is required Refer Section 5.5.2	Ongoing	Maintain fencing to DELWP fencing standards in BushBroker Information Sheet 12 - Standards for Management – Fencing
1-10	26.5 ha of GSM habitat	Erect temporary fencing around offset site during grazing exclusion period (if stock present during this period within the property cannot be confined to certain areas) Refer Section 5.5.2	October -November	Exclude stock from the offset site during exclusion period to protect GSM habitat.
1-10	26.5 ha of GSM habitat	If a threat arises erect an additional fence immediately around the entire boundary of the offset site Refer Section 5.5.2	Immediately on identification of threat	Erect fencing to DELWP fencing standards in BushBroker Information Sheet 12 – Standards for Management – Fencing
1	26.5 ha of GSM habitat	Establish posts to mark the boundary of the offset site in accordance with advice from a qualified ecologist and land surveyor Refer Section 5.5.1.	Immediately on approval of Year 1 of management works	Facilitate management and monitoring of the offset site. Delineate location of temporary exclusion fence.

Year from Commencement	Area	Management Action Description	Timing	Environmental outcome to be achieved
Woody Weeds				
1-10	26.5 ha of GSM habitat	Eliminate all new and emerging woody weeds Refer Section 5.5.3	Ongoing	Eliminate woody weeds (<1% cover)
Herbaceous Weeds				
1-10	26.5 ha of GSM habitat	Control all herbaceous weeds. Refer to Table 4 for list of herbaceous weeds, their control method and timing of actions Refer Section 5.5.3	Refer to Table 6	Eliminate all high threat weeds (<1% cover) within offset site. Minimise off-target damage (avoid all native plants)
1-10	26.5 ha of GSM habitat	Eliminate all new & emerging herbaceous weeds Refer Section 5.5.3	Ongoing.	<1% cover of all new and emerging herbaceous weeds at the end of Year 10
Pest Animals				
1-10	26.5 ha of GSM habitat	Control rabbits and foxes. Refer to Table 5 for a list of control methods and timing of actions Refer Section 5.5.4	Refer to Table 7	No surface disturbance within the offset site; No active rabbit warrens to be present; No active fox dens to be present; No rubbish/artificial harbour present; Minimal artificial piles of logs and rocks;
1-10	26.5 ha of GSM habitat	Monitor and control rabbits and foxes Refer Section 5.5.4	Ongoing	Reduction in the abundance of pest animals, and no detectable impacts to the native grassland
1-10	26.5 ha of GSM habitat	Monitor and control all new and emerging pest animals Refer Section 5.5.4	Ongoing	Control numbers of any new & emerging pest animals

Year from Commencement	Area	Management Action Description	Timing	Environmental outcome to be achieved
Biomass Management				
1-10	26.5 ha of GSM habitat	Pulse grazing Refer Section 5.5.5	The maximum length of continuous grazing is four weeks with at least two weeks rest between cycles. Stock generally excluded during October -November Stock removed immediately following any high rainfall events.	Stock must be removed should total vegetation cover fall to or below 70% Sufficient bare ground (approximately 20% to 40% cover) maintained in order to maintain space for recruitment of herbs and grasses. No loss of native plant diversity as a result of grazing regimes. Reduction in weed cover.
Detailed native vegetation and GSM monitoring				
Years 1-4, 6, 8 and 10	26.5 ha of GSM habitat	Monitoring Refer Section 8.2 and 8.3	Spring/Summer	Allow for ongoing auditing of the effectiveness of management. Reports will include a review of past management works against the performance targets and objectives contained within this OMP.

Year from Commencement	Area	Management Action Description	Timing	Environmental outcome to be achieved
Annual reporting				
1-10	26.5 ha of GSM habitat	Prepare and submit an annual report and photo monitoring to TfN and DAWE. Refer Section 5.5.7 and 8.1	Submit at least 2 months prior to on-title agreement anniversary date	<p>Annual report is signed, dated and submitted by the Landowner at least 2 months prior to the anniversary date of on-title agreement registration</p> <p>Report provides enough detail in the form of written comments and supporting evidence that an assessor can easily determine the completion of / progress against the commitments for the offset site.</p> <p>Allow for ongoing auditing of the effectiveness of management. Reports will include a review of past management works against the performance targets and objectives contained within this OMP. Future management priorities will also be detailed in these reports.</p> <p>Obligations of the Landowner have been met and the obligations form is signed, dated and submitted with the annual report</p>
5	26.5 ha of GSM habitat	Review effectiveness of OMP. Refer Section 5.5.8 and 8.1	End of Year 5.	If existing OMP is not leading to the ongoing maintenance and improvement of the GSM population, a review will be undertaken, and a new management plan prepared for the remaining 5 years of management.

6 CONTINGENCY RESPONSE AND CORRECTIVE ACTIONS

The landholder will use an Adaptive Management Approach to allow the flexibility to respond appropriately and effectively to the uncertainties involved in ecological processes. This will ensure that management objectives are being met while allowing for altered circumstances to be included in the management of the site.

If after Year 5 of management, the actions detailed in this OMP are not leading to the ongoing maintenance and improvement of the GSM habitat, the approval holder will instigate a review of the OMP, and a new management plan will be prepared for the remaining five years of management.

Highly seasonal conditions are not uncommon across western Victoria and can result in variable conditions from year to year. This is acknowledged within the OMP by allowing for a flexible approach to the timing of grazing actions at the discretion of the Landowner.

Any proposed changes to the management contrary to that specified within this plan must be approved by DAWE, prior to implementation. Any proposed uses or development of the site which conflict with the landowners' commitments or maintenance/improvement of the GSM habitat are not permitted under this plan.

Alternative management measures, as part of an adaptive management approach, may be implemented if:

- The management outcomes outlined within Section 5 are unable to be met based on methods outlined within this plan;
- A new management technique has been identified which is considered to be more effective in meeting the objectives of this OMP, and relevant recovery plans, threat abatement plans, conservation advices and does not increase risk of impacts to GSM habitat. A review of the benefits and risks of the proposed management technique must be prepared and submitted to DAWE; and,
- The proposed management technique has been approved by DAWE.

Where management outcomes outlined within Section 5 have not been met during any monitoring event (Section 8) corrective actions must be identified upon submission of the monitoring report.

Where an adaptive management approach has been implemented, the success, or failure, of the approach must be outlined within subsequent monitoring reports. The monitoring report must make recommendations on whether the approach should be continued, or whether subsequent alternative management is recommended.

6.1 Managing Uncertainty

An assessment of potential risks associate with the objectives of this plan are outlined within Table 1. All risks are considered manageable and actions within subsequent sections of this OMP address relevant risks.

7 EMERGENCY CONTACTS AND PROCEDURES

Should any environmental emergency occur on-site that poses a risk to the objectives of this OMP, the relevant contacts (Table 11) must be notified as soon as possible, and no later than 12 hours following the event. At a minimum, DAWE, and the landholder must be notified; CFA and Victoria Police should be notified if assistance is required from these emergency services (e.g. control of wildfire). Emergency services must be advised of the on-site protections to avoid inadvertent damage to ecological values (e.g. creation of graded earthen fire breaks within the site, which unless absolutely necessary, must be avoided).

Table 11. Emergency contacts

Contact	Role	Telephone
Country Fire Authority (CFA)	Bushfire emergency	000
Victoria Police	Various (e.g. unauthorised access)	000
DAWE	Offset Monitoring Responsibility	1800 803 772
TfN	Offset Monitoring Responsibility	03 8631 5888
Landholder	██████████	Undisclosed

8 MONITORING AND REPORTING

Ongoing monitoring is required to determine whether the GSM habitat quality persists and remains viable over time and to ensure that management actions improve habitat.

Site monitoring must include:

- General habitat monitoring (i.e. as described in Section 5.5.7) by the landholder (or an appointed entity on behalf of the landowner) annually; and,
- Detailed monitoring to be conducted by a qualified ecologist for an initial four-year period, and then in Years 6, 8 and 10 of this management plan. This will include a detailed habitat hectares assessment in each year of the detailed monitoring.

Further details on the monitoring actions is outlined below.

8.1 Annual Monitoring of Habitat and Effectiveness of Management actions

The landowner undertakes to establish seven permanent photo-points across the offset site. These points will be marked via GPS and shown on a Figure. Photographs taken from these points will be representative of the vegetation and objectives of the OMP (e.g. areas of high threat weed invasion). Photographs will be taken in October annually and clearly labelled. Each photo will be taken from as near to the same point each year and will use the same direction, trajectory and camera settings as is practicable.

Annual monitoring must be undertaken by the landowner (or an appointed entity on behalf of the landowner), and must include an assessment of:

- Photographs taken at established photo-points;
- The extent, severity, trend and presence of current weed species and any new and emerging weed species.
- The extent, severity, trend and presence of pest animal activity;
- Biomass levels, visually assessed across the site;
- Evidence of unpermitted human/stock access; and,
- Any new threats.

The annual monitoring must be undertaken for each year of the 10 Years of this Offset Management Plan.

8.2 Detailed Vegetation Monitoring (Years 1-4, 6, 8 and 10)

Detailed vegetation monitoring will be instigated by the approval holder and conducted by a qualified ecologist for an initial four-year period, and then in Years six, eight and 10 of this management plan, and will document the following components:

- Overall assessment of the quality and quantity of vegetation and composition of species (i.e. Habitat Hectare assessment*);
- Biomass levels, assessed through 14 x 1 m² sampling plots equidistant along the offset site; and,
- The extent, severity, trend and presence of current weed species and any new and emerging weed species.

* Department of Sustainability and Environment 2004. *Vegetation quality assessment manual: Guidelines for applying the habitat hectares scoring method. Version 1.3.* Victorian Department of Sustainability and Environment, Melbourne Victoria

8.3 Golden Sun Moth population monitoring (Years 1-4, 6, 8 and 10)

In addition to native vegetation monitoring outlined in Section 8.2, appropriate monitoring of GSM will be undertaken for an initial four year period, and then in years 6, 8 and 10 of this management plan, or thereafter upon written agreement with the Commonwealth Minister for Environment. The GSM monitoring detailed below is to be instigated by the Approval holder, and undertaken by trained observers (i.e. suitably qualified ecologist). If the results indicate a decline in the population size or habitat degradation becomes evident, actions within this management plan will be re-evaluated. If any changes to management are required in the landowners' view, a revised management strategy must be approved by DAWE prior to implementation.

Specific survey procedures will follow those approved monitoring guidelines for GSM prepared by DEWHA*. The following measures will be undertaken as part of population and habitat monitoring for GSM at the offset site:

- Surveys are to be conducted by suitably trained observers;
- Surveys will concentrate in areas identified as supporting indigenous grassland, namely those supporting wallaby-grass *Rytidosperma* spp. which is a known food source for Golden Sun Moth.
- Surveys will be conducted over a minimum of four separate days during the known flight season (i.e. November to early January).
- Surveys will be undertaken at a time which is considered suitable for detecting the species (i.e. when adult males are flying), and when Golden Sun Moth was observed flying at nearby locations. (The male of this species generally flies between 11am and 3pm on calm, warm (over 20°C), sunny days).

* Department of the Environment, Water, Heritage and the Arts 2009. *Significant impact guidelines for the critically endangered golden sn moth (*Synemon plana*)*. EPBC Act policy statement 3.12.

8.4 Reporting

To demonstrate that the management measures are effective in meeting the environmental outcomes, this OMP requires the approval holder to submit a report annually DAWE for each year of the 10 Years of this Offset Management Plan.

Photographs and reports are to be submitted at least two months prior to the anniversary date of the execution of the agreement to allow time for compliance to be assessed before the anniversary date.

The report must address progress against the commitments set out in this agreement and the conditions of the EPBC Act referral (EPBC 2018/8260). Reports should provide enough detail in the form of written

comments and supporting evidence that an assessor can easily determine the completion of/progress against the commitments for the offset site.

Information to be provided in the progress report includes:

- Detailing actions completed during the reporting period;
- Results of vegetation condition assessment (Habitat Hectare Assessment);
- Results of GSM population monitoring;
- A description of the specific monitoring results from ecological surveys undertaken;
- Results of weed and pest animal control work;
- Successful management tools (i.e. techniques used to control weed species, monitoring technique, etc.);
- Any problems or issues experienced (i.e. new infestation of weed species, etc.);
- Any corrective actions and contingency measures where monitoring indicates that there has been a deterioration in the native vegetation;
- Photographs showing evidence of works; and,
- Assessment on how the site is on track to meet, or meets the conditions under the EPBC referral (EPBC 2018/8260), including an assessment against the EPBC offset gain calculator inputs

If any agreed management actions or commitments (excluding third party monitoring) are incomplete or have not been undertaken in the times specified, the landowner is to document the justification and the substituted actions that will be undertaken in order to compensate and ensure the required outcomes are achieved.

All records/evidence of management actions must be maintained and be submitted to DAWE upon request.

REFERENCES

- AECOM 2015. Ecological surveys for Matters of National Environmental Significance at [REDACTED].
- DELWP 2020. Native Vegetation Information Management Tool [www Document]. URL: <<https://nvim.delwp.vic.gov.au/>>. Victorian Department of Environment, Land, Water and Planning, Melbourne, Victoria.
- DEWHA 2009. Significant impact guidelines for the critically endangered Golden Sun Moth (*Synemon plana*). Background paper to EPBC Act policy statement 3.12. Canberra, Australia: Department of the Environment, Water, Heritage and the Arts. Pp 19.
- DoE 2013. Approved Conservation Advice for *Synemon plana* (golden sun moth). Canberra: Department of the Environment. Department of Environment, Canberra.
- DAWE 2016. Threat abatement plan for competition and land degradation by rabbits. Department of the Environment and Energy, Commonwealth of Australia 2016.
- DoEE 2017. Threat Abatement Plan for predation, habitat degradation, competition and disease transmission by feral pigs (*Sus scofra*) (2017). Department of the Environment and Energy, Commonwealth of Australia 2017.
- DSE 2009. BushBroker: Standards for management – Ecological grazing: Information Sheet No. 13. DSE, East Melbourne.
- DSE 2004. Vegetation quality assessment manual: Guidelines for applying the habitat hectares scoring method. Version 1.3. Victorian Department of Sustainability and Environment, Melbourne Victoria
- DSEWPaC 2011. Nationally Threatened Ecological Communities of the Victorian Volcanic Plain: Natural Temperate Grassland & Grassy Eucalypt Woodland. Department of Sustainability, Environment, Water, Population and Communities, Canberra.
- DSEWPaC 2012a. *Environment Protection and Biodiversity Conservation Act 1999* Environmental Offsets Policy (October 2012). Department of Sustainability, Environment, Water, Population and Communities, Canberra.
- DSEWPaC 2012b. Offsets Assessment Guide: For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999* (2 October 2012). Microsoft Excel spreadsheet developed by the Department of Sustainability, Environment, Water, Population and Communities, Canberra.
- Ecology and Heritage Partners 2018. Preparation of EPBC Act referral for Parwan to Melton Pipeline, Victoria (EPBC 2018/8260).
- Ecology and Heritage Partners 2020a. Offset site assessment: Mount Gow, Shelford, Victoria. Prepared for Western Water.
- Ecology and Heritage Partners 2020b. Preliminary Documentation: Parwan to Melton Recycled Water Pipeline (EPBC 2018/8260). Prepared for Western Water.
- Ecology and Heritage Partners 2020c. Biodiversity Assessment and Targeted Surveys: Interconnector Pipeline Project, Parwan to Melton. Prepared for Western Water.

Mavromihalis, J., Dorrough, J., Clark, S., Turner, V., and Moxham, C. 2013. Manipulating livestock grazing to enhance native plant diversity and cover in native grasslands. *The Rangeland Journal* 35, 95-108.

FIGURES



Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

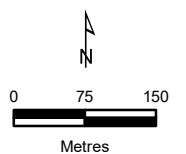
Figure 1
GSM Offset Site
 EPBC 2018/8260,
 Mount Gow,
 Shelford, Victoria

Legend

- Study Area
- ◆ African Box-thorn
- ◆ Rabbit warren
- Golden Sun Moth records (9/12/2019)
- Golden Sun Moth records (16/12/2019)
- Golden Sun Moth habitat

Ecological Vegetation Classes

- Plains Grassland
- NTGVVP
- Proposed offset sites for EPBC Act referral 2018/8260**
- Proposed high quality GSM offset site (20.5 ha)
- Proposed moderate quality GSM offset site (6 ha)



VicMap Data: The State of Victoria does not warrant the accuracy or completeness of information in this publication and any person using or relying upon such information does so on the basis that the State of Victoria shall bear no responsibility or liability whatsoever for any errors, faults, defects or omissions in the information.

Appendix 1. Risk Assessment and Management Definitions

Risk framework

		Consequence				
		Minor	Moderate	High	Major	Critical
Likelihood	Highly Likely	Medium	High	High	Severe	Severe
	Likely	Low	Medium	High	High	Severe
	Possible	Low	Medium	Medium	High	Severe
	Unlikely	Low	Low	Medium	High	High
	Rare	Low	Low	Low	Medium	High

Likelihood and consequence

Qualitative measure of likelihood (how likely is it that this event/circumstances will occur after management actions have been put in place/are being implemented)	
Highly likely	Is expected to occur in most circumstances
Likely	Will probably occur during the life of the project
Possible	Might occur during the life of the project
Unlikely	Could occur but considered unlikely or doubtful
Rare	May occur in exceptional circumstances
Qualitative measure of consequences (what will be the consequence/result if the issue does occur)	
Minor	Minor risk of failure to achieve the plan's objectives. Results in short term delays to achieving plan objectives, implementing low cost, well characterised corrective actions.
Moderate	Moderate risk of failure to achieve the plan's objectives. Results in short term delays to achieving plan objectives, implementing well characterised, high cost/effort corrective actions.
High	High risk of failure to achieve the plan's objectives. Results in medium-long term delays to achieving plan objectives, implementing uncertain, high cost/effort corrective actions.
Major	The plan's objectives are unlikely to be achieved, with significant legislative, technical, ecological and/or administrative barriers to attainment that have no evidenced mitigation strategies.
Critical	The plan's objectives are unable to be achieved, with no evidenced mitigation strategies.

Appendix 2. EPBC OFFSET CALCULATOR

Offsets Assessment Guide

For use in determining offsets under the Environment Protection and Biodiversity Conservation Act 1999
2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	Golden Sun Moth
EPBC Act status	Critically Endangered
Annual probability of extinction Based on IUCN category definitions	6.8%

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator						
Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
<i>Ecological communities</i>						
Area of community	No		Area			
			Quality			
			Total quantum of impact	0.00		
<i>Threatened species habitat</i>						
Area of habitat	Yes	Golden Sun Moth habitat	Area	5.257	Hectares	Field mapping
			Quality	5	Scale 0-10	
			Total quantum of impact	2.63	Adjusted hectares	
<i>Threatened species</i>						
Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Number of features e.g. Nest hollows, habitat trees	No					
Condition of habitat Change in habitat condition, but no change in extent	No					
Birth rate e.g. Change in nest success	No					
Mortality rate e.g. Change in number of road kills per year	No					
Number of individuals e.g. Individual plants/animals	No					

Offset calculator																										
Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost (\$ total)	Information source						
<i>Ecological Communities</i>																										
Area of community	No				Risk-related time horizon (max. 20 years)		Start area (hectares)	Risk of loss (%) without offset		Risk of loss (%) with offset																
								Future area without offset (adjusted hectares)	0.0	Future area with offset (adjusted hectares)	0.0															
								Time until ecological benefit		Start quality (scale of 0-10)		Future quality without offset (scale of 0-10)		Future quality with offset (scale of 0-10)												
<i>Threatened species habitat</i>																										
Area of habitat	Yes	2.63	Adjusted hectares	26.5 ha total (20.5 high quality and 6 moderate quality)	Time over which loss is averted (max. 20 years)	20	Start area (hectares)	20.5	Risk of loss (%) without offset	5%	Risk of loss (%) with offset	1%														
									Future area without offset (adjusted hectares)	19.5	Future area with offset (adjusted hectares)	20.3	Raw gain	0.82	Confidence in result (%)	90%	Adjusted gain	0.74	Net present value	0.20	% of impact offset	73.60%	Minimum (90%) direct offset requirement met?	No		
									Time until ecological benefit	10	Start quality (scale of 0-10)	5	Future quality without offset (scale of 0-10)	4	Future quality with offset (scale of 0-10)	6	Raw gain	2.00	Confidence in result (%)	90%	Adjusted gain	1.80	Net present value	0.93		
<i>Threatened species</i>																										
Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start value		Future value without offset		Future value with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value	% of impact offset	Minimum (90%) direct offset requirement met?	Cost (\$ total)	Information source						
Number of features e.g. Nest hollows, habitat trees	No																									
Condition of habitat Change in habitat condition, but no change in extent	No																									
Birth rate e.g. Change in nest success	No																									
Mortality rate e.g. Change in number of road kills per year	No																									
Number of individuals e.g. Individual plants/animals	No																									

Summary							
Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost (\$)		
					Direct offset (\$)	Other compensatory measures (\$)	Total (\$)
Birth rate	0				\$0.00		\$0.00
Mortality rate	0				\$0.00		\$0.00
Number of individuals	0				\$0.00		\$0.00
Number of features	0				\$0.00		\$0.00
Condition of habitat	0				\$0.00		\$0.00
Area of habitat	2.6285	1.93	73.60%	No	\$0.00	#DIV/0!	#DIV/0!
Area of community	0				\$0.00		\$0.00
					\$0.00	#DIV/0!	#DIV/0!

Offsets Assessment Guide

For use in determining offsets under the Environment Protection and Biodiversity Conservation Act 1999
2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	Golden Sun Moth
EPBC Act status	Critically Endangered
Annual probability of extinction Based on IUCN category definitions	6.8%

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator						
Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
<i>Ecological communities</i>						
Area of community	No		Area			
			Quality			
			Total quantum of impact	0.00		
<i>Threatened species habitat</i>						
Area of habitat	Yes	Golden Sun Moth habitat	Area	5.257	Hectares	Field mapping
			Quality	5	Scale 0-10	
			Total quantum of impact	2.63	Adjusted hectares	
<i>Threatened species</i>						
Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Number of features e.g. Nest hollows, habitat trees	No					
Condition of habitat Change in habitat condition, but no change in extent	No					
Birth rate e.g. Change in nest success	No					
Mortality rate e.g. Change in number of road kills per year	No					
Number of individuals e.g. Individual plants/animals	No					

Offset calculator																				
Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost (\$ total)	Information source
<i>Ecological Communities</i>																				
Area of community	No				Risk-related time horizon (max. 20 years)		Start area (hectares)	Risk of loss (%) without offset		Risk of loss (%) with offset										
								Future area without offset (adjusted hectares)	0.0	Future area with offset (adjusted hectares)	0.0									
								Time until ecological benefit		Start quality (scale of 0-10)		Future quality without offset (scale of 0-10)		Future quality with offset (scale of 0-10)						
<i>Threatened species habitat</i>																				
Area of habitat	Yes	2.63	Adjusted hectares	26.5 ha total (20.5 high quality and 6 moderate quality)	Time over which loss is averted (max. 20 years)	20	Start area (hectares)	6	Risk of loss (%) without offset	5%	Risk of loss (%) with offset	1%								
									Future area without offset (adjusted hectares)	5.7	Future area with offset (adjusted hectares)	5.9	0.24	90%	0.22	0.06				
									Time until ecological benefit	10	Start quality (scale of 0-10)	4	Future quality without offset (scale of 0-10)	3	Future quality with offset (scale of 0-10)	6	3.00	75%	2.25	1.17
<i>Threatened species</i>																				
Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start value		Future value without offset		Future value with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value	% of impact offset	Minimum (90%) direct offset requirement met?	Cost (\$ total)	Information source
Number of features e.g. Nest hollows, habitat trees	No																			
Condition of habitat Change in habitat condition, but no change in extent	No																			
Birth rate e.g. Change in nest success	No																			
Mortality rate e.g. Change in number of road kills per year	No																			
Number of individuals e.g. Individual plants/animals	No																			

Summary							
Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost (\$)		
					Direct offset (\$)	Other compensatory measures (\$)	Total (\$)
Birth rate	0				\$0.00		\$0.00
Mortality rate	0				\$0.00		\$0.00
Number of individuals	0				\$0.00		\$0.00
Number of features	0				\$0.00		\$0.00
Condition of habitat	0				\$0.00		\$0.00
Area of habitat	2.6285	0.70	26.59%	No	\$0.00	#DIV/0!	#DIV/0!
Area of community	0				\$0.00		\$0.00
					\$0.00	#DIV/0!	#DIV/0!

Appendix 3. Offset Site Assessment Report

Offset Site Assessment: Mount Gow, Shelford, Victoria

Date: 12 May 2020

Author: Claire Ranyard (Consultant Botanist)

Ref: 10223

1 Introduction

Ecology and Heritage Partners Pty Ltd was commissioned by CH2M Beca on behalf of Western Water to undertake a site assessment at Mount Gow, Shelford, Victoria. The purpose of the assessment was to confirm the ecological values present within the study area. An initial assessment of the offset site was undertaken by AECOM (2015), and a subsequent assessment was undertaken by Ecology and Heritage Partners in early 2020 to confirm the current extent and condition of the vegetation and ecological values within the offset site, with the results presented in the current report.

The initial assessment undertaken by AECOM (2015) identified two matters listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) present within the property, Golden Sun Moth *Synemon plana* and Natural Temperate Grassland of the Victorian Volcanic Plain (NTGVVP).

The current report details the extent of NTGVVP through recent mapping and provides an assessment of the quality of NTGVVP present within the study area, including the native species composition, weed cover, and presence of pest animals. Golden Sun Moth surveys were undertaken in December 2019, with the results presented below. The results of the field assessment will be used to calculate the area of NTGVVP and Golden Sun Moth habitat to be protected to meet the offset requirements of Western Water for a current development project which involves the removal of NTGVVP and Golden Sun Moth habitat.

2 Study Area

The third-party offset site (offset site) is located at a private property in Mount Gow, Shelford, Victoria, approximately 90 kilometres south-west of the impact site in Parwan, Victoria (Figure 1). The offset site will protect 3.45 hectares of NTGVVP and 26.5 hectares of Golden Sun Moth habitat and is part of a larger property intersected by Warrambine Creek and abutting 35 kilometres of Mount Gow Road. All areas identified as NTGVVP and Golden Sun Moth habitat within the offset site are proposed to be managed for vegetation offset and conservation purposes.

According to the Victorian Department of Environment, Land, Water and Planning (DELWP) NatureKit Map (DELWP 2020a), the study area occurs within the Victorian Volcanic Plain Bioregion. It is located within the jurisdiction of the Corangamite Catchment Management Authority (CMA) and the Golden Plains Shire municipality.

3 Field Assessment

Where native vegetation was identified a habitat hectare assessment was undertaken following methodology described in the Vegetation Quality Assessment Manual (DSE 2004).

3.1 Natural Temperate Grassland of the Victorian Volcanic Plain

A field assessment of the study area was undertaken by a qualified ecologist on 24 January 2020 and 24 February 2020. The inspection sought primarily to identify the extent and condition of the NTGVVP ecological community, and to identify the presence of any key threats to the community, such as weeds and pest animals. The entire study area was walked, and where potential patches of NTGVVP were identified, the patch was assessed against the diagnostic and condition thresholds for the community (DSEWPC 2011) to determine if it was eligible for listing.

3.2 Golden Sun Moth Surveys

Targeted surveys for GSM were undertaken over two separate days during the known flight season, on 9 and 16 of December 2019 by zoologists experienced in the detection and identification of the species. The presence of GSM flying at known reference sites (i.e. Merrimu, Craigieburn Grasslands) was used to confirm suitable days for surveys. Surveys were undertaken at a time which is considered suitable for detecting the species (i.e. when adult males are flying), between 10:00 am and 3:00 pm on calm, warm (over 20°C), sunny days with still conditions. All surveys were undertaken on foot.

Surveys concentrated on areas identified as supporting suitable habitat, which included areas dominated by Spear-grass *Austrostipa* spp. and Wallaby-grass *Rytidosperma* spp., a known food source for GSM.

AECOM (2015) recorded a low number of Golden Sun Moth within the offset area on 15 December 2014, and the purpose of the current surveys was to confirm that Golden Sun Moth were still present within the proposed offset area. Survey procedures were in accordance with the *Significant Impact Guidelines for the Critically Endangered Golden Sun Moth* (DEWHA 2009), with the following tasks undertaken:

- A habitat assessment was completed detailing information on habitat quality, presence of weeds and floristic diversity;
- Surveys were conducted by ecologists experienced in the detection and identification of Golden Sun Moth;
- The study area was surveyed on two separate occasions, with at least one week between surveys;
- Surveys took place during the species' flight season (generally described as late October to early January). Moths were confirmed flying at known, nearby reference sites (Broadmeadows) prior to undertaking each survey;
- Surveys were undertaken during weather conditions suitable for detecting the species (i.e. between 10am and 3pm on warm (over 20°C by 10am) days with minimal cloud cover and still conditions); and
- Surveys were conducted by qualified zoologists walking or driving (where access was permitted) 10 to 50-metre-wide parallel transects across all areas of suitable habitat.

3.3 EPBC Act

Offsets under the EPBC are calculated in accordance with the Commonwealth environmental offset policy (DSEWPaC 2012a) and the EPBC Act offset calculator (DSEWPaC 2012b).

Refer to Appendix 2 of the Preliminary Documentation (Ecology and Heritage Partners 2020) for the gain calculations under the EPBC Act for NTGVVP and Golden Sun Moth habitat based on the impact site and proposed offsets site conditions.

3.4 Assessment Qualifications and Limitations

It is important to acknowledge that the number of documented records for the target species within and surrounding the study area is not necessarily a reflection of population size or density. Furthermore, a documented record may indicate a species' presence in an area at a given point in time, but it generally does not offer information about how a species is making use of an area (e.g. foraging, dispersing, reintroducing, etc.). This can be important information when determining the potential impact of a proposed action on a threatened species.

Targeted surveys were undertaken during optimal seasons for the identification of the targeted fauna species. Based on available information the Golden Sun Moth flight season commenced at a majority of sites in early-mid November 2019, with moths expected to fly through to early-January 2020. It is considered that the survey effort, timing and results presented meet the objectives of the surveys and provide sufficient information to support the approvals processes. Known reference sites were checked prior to the commencement of surveys to confirm that the species was flying on survey days.

Fauna surveys were conducted under the Ecology and Heritage Partners Pty Ltd research permit (#10005952) issued by DELWP under the *Wildlife Act 1975*.

4 Results

4.1 Overall Site Condition

The majority of the study area was characterised by the Ecological Vegetation Class (EVC) *Heavier-soils Plains Grassland* (EVC 132_61). This EVC is represented by treeless vegetation, dominated by native grasses and herbs within areas that receive at least 500 mm annual rainfall.

Three quality conditions of Plains Grassland were recorded, several high quality patches (PG1; Plate 1), one moderate quality patch, (PG2; Plate 2) and a larger lower quality patch (PG3) (Figure 2). Condition scores based on the habitat hectares assessment for each patch are provided in Appendix 2.

The high and moderate quality patches (PG1 and PG2) meet the key criteria for listing as NTGVVP with a total of 19.12 hectares of NTGVVP recorded within the study area. Further details of the NTGVVP patch are provided in Section 4.2. Surrounding the patch of NTGVVP is lower quality Plains Grassland and the entire study area is confirmed habitat for Golden Sun Moth *Synemon plana*.

Native grass species commonly observed across the site included Spear-grass., Wallaby-grass, Common Wheat-grass *Anthosachne scabra*, Common Tussock-grass *Poa labillardierei*, and native herbs included Bronze Bluebell *Wahlenbergia luteola*, Blue Devil *Eryngium ovinum*, Grassland Wood-sorrel *Oxalis perennans*, Crane's-

bill *Geranium* sp., Pink Bindweed *Convolvulus* sp., Yellow Rush Lily *Tricoryne elatior*, Narrow Plantain *Plantago gaudichaudii* and Twining Glycine *Glycine clandestina* (Plate 3).

Weeds are scattered across the study area with Toowoomba Canary-grass *Phalaris aquatica* being the dominant weed present. All other weeds were present in low concentrations. One woody weed, African Boxthorn *Lycium ferocissimum*, was present in limited numbers with approximately 10 individuals observed, primarily in the north eastern corner of the offset site (Plate 4). A few rabbit warrens were recorded, and several rock piles are present which may harbour pest animal species.



Plate 1. High quality Plains Grassland within the study area (Ecology and Heritage Partners Pty Ltd 24/02/2020.).



Plate 2. Moderate quality patches of Plains Grassland present within the study area (Ecology and Heritage Partners Pty Ltd 24/02/2020).



Plate 3. Native herbs present within the study area (Ecology and Heritage Partners Pty Ltd 24/02/2020).



Plate 4. Small patch of African Box-thorn present within the study area Ecology and Heritage Partners Pty Ltd 24/02/2020).

4.2 Natural Temperate Grassland of the Victorian Volcanic Plain

PG1 and PG2 contained a moderate to high cover of native perennial grasses and met the condition threshold that define the NTGVVP community. Native grasses present included Spear-grasses, Wallaby-grasses. and Common Wheat-grass.

Weed cover within PG1 was low, with scattered occurrences of Wild-oat, Toowoomba Canary-grass and Ribwort *Plantago lanceolata*, and several African Box-thorn in the north eastern section of the patch. PG2 had a higher cover of Toowoomba Canary-grass, however still contained at least 50% cover of native perennial grasses and no woody weeds.

4.2.1 Condition Thresholds for listing as Natural Temperate Grassland of the Victorian Volcanic Plain

Step 1 – Determining if the Natural Temperate Grassland ecological community is present.

- Does the patch occur within or near the Victorian Volcanic Plain Bioregion? **Yes**
- Is the patch dominated by native vegetation? **Yes**
- Are trees absent or sparse? **Yes – absent**
- Is the ground vegetation dominated by native grasses and/or herbs? **Yes**

Step 2 – Determining if the patch is of sufficient quality for national listing.

- Is the patch bigger than or equal to 0.05 hectares? **Yes – 19.12 hectares mapped**
- Do the dominant native species represent at least 50% of the native species and the perennial tussock cover? **Yes**

Result: The patch meets the condition thresholds for the nationally significant ecological community.

4.3 Pest and Weed Condition

Table 1 and Table 2 below detail the species and percentage cover of pest animal and weed infestations present within the NTGVVP patches, noting that no woody weeds were recorded in PG2.

Table 1. Pest animals recorded within NTGVVP patches.

Habitat zone	Common name	Scientific name	Notes on threat
PG1	European Rabbit	<i>Oryctolagus cuniculus</i>	Small warrens were recorded within and surrounding habitat zone impacting upon native vegetation. Rock pile adjacent to zone which may harbor pest fauna.
	Red Fox	<i>Vulpes vulpes</i>	Small amount of disturbance, no dens observed within habitat zone.
PG2	European Rabbit	<i>Oryctolagus cuniculus</i>	Small warrens were recorded within and surrounding habitat zone impacting upon native vegetation.
	Red Fox	<i>Vulpes vulpes</i>	Small amount of disturbance, no dens observed within habitat zone.

Table 2. Woody weeds recorded within patches of NTGVVP

Habitat zone	Common name	Scientific name	Notes on threat
PG1	African Box-thorn	<i>Lycium ferocissimum</i>	A low number of African Box-thorn were recorded within PG1. Eradication will be achievable within a prescribed 10-year management plan.

Table 3. Total cover of woody weeds recorded in PG₁ habitat zone

Habitat zone	Total cover of woody weeds recorded (%)
PG₁	1% total cover of woody weeds within PG ₁ habitat zone.

Table 4. Total cover of herbaceous and grassy weeds recorded in NTGVVP patches

Habitat zone	Total cover of ALL herbaceous and grassy weeds (%)	Total cover of high threat herbaceous and grassy weeds (%)
PG₁	30% - Common weeds; Toowoomba Canary-grass, Wild Oat	20% - Common high threat weeds; Toowoomba Canary-grass
PG₂	40% - Common weeds; Toowoomba Canary-grass, Wild Oat	30% - Common high threat weeds; Toowoomba Canary-grass

4.4 Golden Sun Moth Targeted Survey

Targeted surveys for Golden Sun Moth were undertaken over two separate days during the known flight season, on 9 and 16 of December 2019, with approximately 60 Golden Sun Moth recorded during the surveys (Figure 2). A summary of survey results, reference site where Golden Sun Moth were known to be flying on the survey day and weather conditions is given below in Table 5.

Table 5. Golden Sun Moth survey results

Date	Survey times	Reference Site*	Temperature (°C)	Wind (km/hr)	Cloud cover (%)	No. of days since rain	No. GSM
09/12/2019	10:00 – 15:00	Craigieburn	35.0	17	10	5	2
16/12/2019	10:00 – 15:30	Broadmeadows	23.0	15	0	7	60+

*reference site refers to known locations of GSM populations where individuals were recorded flying on the day of the relevant survey to allow confidence that the survey conditions were suitable.

5 Discussion

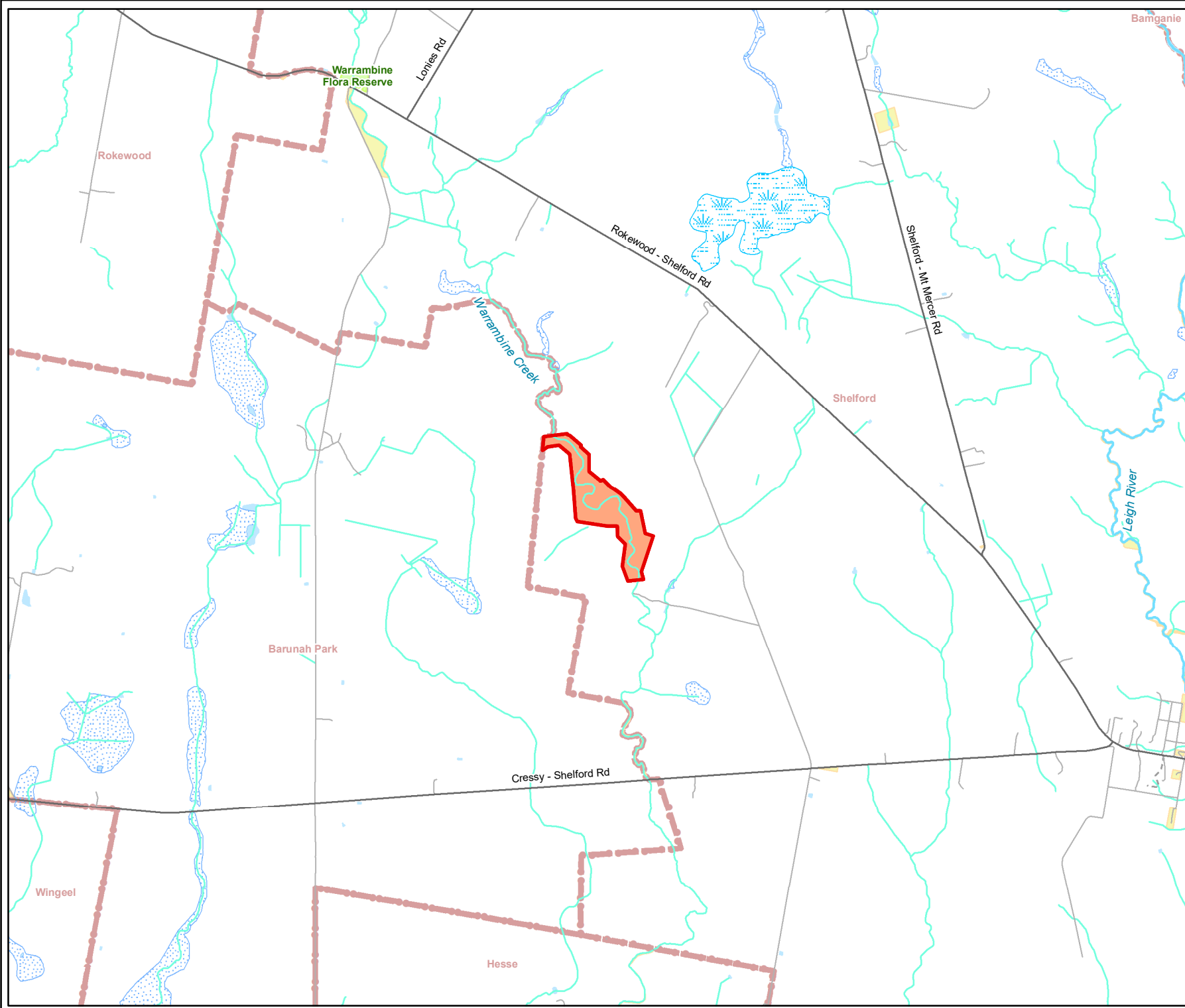
Several patches (PG_{1a-g}; PG_{2a}) of NTGVVP were recorded within the study area, totalling 19.12 hectares of NTGVVP within the broader proposed offset area. The remaining patches (PG₃) do not currently meet the condition thresholds for listing as the ecological community due to the high weed cover (up to 40%), however, may meet the thresholds in the future if the weed cover within the patch is reduced, primarily through the reduction in cover of the perennial weed, Toowoomba Canary-grass.

Golden Sun Moth surveys were undertaken within the northern section of the study area, with numerous individuals recorded flying in the grassland patches, in both NTGVVP and lower quality Plains Grassland areas.

The offset site contains the required 3.45 hectares of NTGVVP and 26.5 hectares of Golden Sun Moth habitat to offset the removal of each matter of National Environmental Significance at the impact site.

References

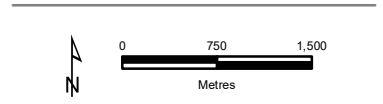
- DELWP 2020. NatureKit Map [www Document]. URL: <http://maps.biodiversity.vic.gov.au/viewer/?viewer=NatureKit>. Victorian Department of Environment, Land, Water and Planning, Melbourne, Victoria.
- DEWHA 2009b. Significant impact guidelines for the critically endangered Golden Sun Moth (*Synemon plana*). Nationally threatened species and ecological communities EPBC Act policy statement 3.12. Department of Environment, Water, Heritage and the Arts. Commonwealth of Australia, Canberra.
- DSE 2004. Vegetation quality assessment manual: Guidelines for applying the habitat hectares scoring method. Version 1.3. Victorian Department of Sustainability and Environment, Melbourne Victoria
- DSEWPC 2011. Nationally Threatened Ecological Communities of the Victorian Volcanic Plain: Natural Temperate Grassland and Grassy Eucalypt Woodland. Department of Sustainability, Environment, Water, Population and Communities, Canberra.
- DSEWPaC 2012a. Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy (October 2012). Department of Sustainability, Environment, Water, Population and Communities, Canberra.
- DSEWPaC 2012b. Offsets Assessment Guide: For use in determining offsets under the Environment Protection and Biodiversity Conservation Act 1999 (2 October 2012). Microsoft Excel spreadsheet developed by the Department of Sustainability, Environment, Water, Population and Communities, Canberra.
- Ecology and Heritage Partners 2020. Preliminary Documentation: Parwan to Melton Recycled Water Pipeline (EPBC 2018/8260). Prepared for CH2M Beca (on behalf of Western Water).



- Legend**
- Study Area
 - Collector Road
 - Minor Road
 - Proposed Road
 - Minor Watercourse
 - Major Watercourse
 - Permanent Waterbody
 - Land Subject to Inundation
 - Wetland/Swamp
 - Parks and Reserves
 - Crown Land
 - Localities

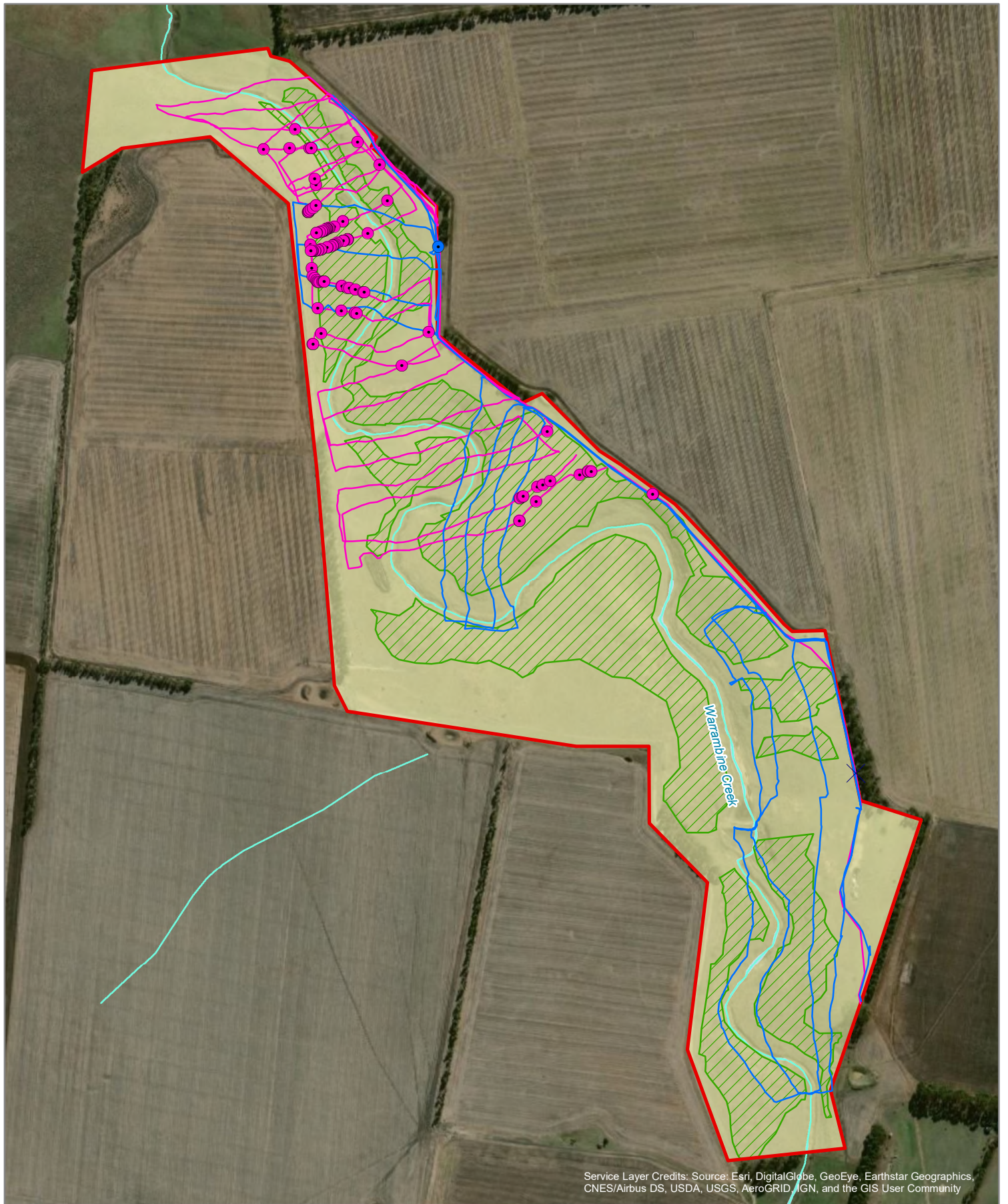


Figure 1
Location of the study area
EPBC 2018/8260, Mount Gow,
Shelford, Victoria



VicMap Data: The State of Victoria does not warrant the accuracy or completeness of information in this publication and any person using or relying upon such information does so on the basis that the State of Victoria shall bear no responsibility or liability whatsoever for any errors, faults, defects or omissions in the information.

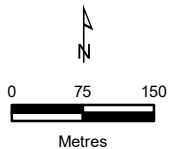
10223 Fig01 StudyArea 7/05/2020 Irvy



Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Figure 2
Ecological features
Matters of National Environmental Significance recorded at Mount Gow, Shelford, Victoria

- Legend**
- Study Area
 - Golden Sun Moth records (9/12/2019)
 - Golden Sun Moth records (16/12/2019)
 - Survey tracks (9/12/2019)
 - Survey tracks (16/12/2019)
 - Golden Sun Moth habitat
 - Natural Temperate Grassland of the Victorian Volcanic Plain



VicMap Data: The State of Victoria does not warrant the accuracy or completeness of information in this publication and any person using or relying upon such information does so on the basis that the State of Victoria shall bear no responsibility or liability whatsoever for any errors, faults, defects or omissions in the information.



Appendix 1 – Flora List

Legend:

* Listed as a noxious weed under the CaLP Act;

w Weed of National Significance;

Table A1.1. Flora recorded within the study area

Scientific Name	Common Name	Conservation Status/Notes
INDIGENOUS SPECIES		
<i>Alternanthera denticulata</i>	Lesser Joyweed	-
<i>Anthosachne scabra</i>	Common Wheat-grass	-
<i>Austrostipa</i> spp.	Spear-grass	-
<i>Convolvulus</i> sp.	Pink Bindweed	-
<i>Eryngium ovinum</i>	Blue Devil	-
<i>Eryngium vesiculosum</i>	Prickfoot	-
<i>Geranium</i> sp.	Crane's Bill	-
<i>Glycine clandestina</i>	Twining Glycine	-
<i>Oxalis perennans</i>	Grassland Wood-sorrel	-
<i>Plantago gaudichaudii</i>	Narrow Plantain	-
<i>Poa labillardieri</i>	Common Tussock-grass	-
<i>Rytidosperma</i> spp.	Wallaby-grass	-
<i>Tricoryne elatior</i>	Yellow Rush lily	-
<i>Walenbergia luteola</i>	Bronze Bluebell	-
NON-INDIGENOUS OR INTRODUCED SPECIES		
<i>Acetosella vulgaris</i>	Sheep Sorrel	-
<i>Avena fatua</i>	Wild Oat	-
<i>Cirsium vulgare</i>	Spear Thistle	*
<i>Hordeum</i> spp.	Barley Grass	-
<i>Hypochaeris radicata</i>	Cat's-ear	-
<i>Lycium ferocissimum</i>	African Box-thorn	w*
<i>Nassella trichotoma</i>	Serrated Tussock	w*
<i>Phalaris aquatica</i>	Toowoomba Canary-grass	*
<i>Romulea rosea</i>	Onion Weed	-
<i>Vulpia</i> spp.	Rat-tail Fescue	-

Appendix 2 – Habitat Hectare Assessment

Table A2.1. Habitat Hectare Table for patches of Plains Grassland within the offset area.

Vegetation Zone		PG1	PG2	PG3
Bioregion		Victorian_Volcanic_Plain	Victorian_Volcanic_Plain	Victorian_Volcanic_Plain
EVC / Tree		Plains Grassland (Heavier Soils)	Plains Grassland (Heavier Soils)	Plains Grassland (Heavier Soils)
EVC Number		132_61	132_61	132_61
EVC Conservation Status		Endangered	Endangered	Endangered
Patch Condition	Large Old Trees /10	na	na	na
	Canopy Cover /5	na	na	na
	Under storey /25	15	10	10
	Lack of Weeds /15	6	4	2
	Recruitment /10	6	6	3
	Organic Matter /5	5	4	4
	Logs /5	na	na	na
	Treeless EVC Multiplier	1.36	1.36	1.36
	Subtotal =	43.52	32.64	25.84
Landscape Value /25	16	16	16	
Habitat Points /100	60	49	42	
Habitat Score		0.60	0.49	0.39