Final Report

Annual Report for the Caroline Springs Railway Station Grassland – Year 5

PREPARED FOR

Vic Track

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- *Pimelea spinescens* Recovery Team (PsRT).

GLOSSARY

Acronym	Description
CMP	Conservation Management Plan
DELWP	Victorian Department of Environment, Land, Water and Planning
DoEE	Commonwealth Department of Environment and Energy
EPBC Act	*Environmental Protection and Biodiversity Conservation Act 1999* (Commonwealth)
NTGVVP	Natural Temperate Grassland of the Victorian Volcanic Plain
OMP	Offset Management Plan
PsRT	*Pimelea spinescens* Recovery Team
SLL	Striped Legless Lizard *Delma impar*
SRF	Spiny Rice-flower *Pimelea spinescens* subsp. *spinescens*
WLS	Western Land Services

EXECUTIVE SUMMARY

Ecology and Heritage Partners were engaged by VicTrack to undertake the Year 5 monitoring of the conservation reserve and associated native grassland, in accordance with the EPBC referral 2010/5463, and the corresponding Conservation Management Plan and Offset Management Plan.

This report details the results of the Year 5 monitoring, including the status of the Spiny Rice-flower *Pimelea spinescens* subsp. *spinescens* population, Striped Legless Lizard *Delma impar* population and condition of the ecological community, *Natural Temperate Grassland of the Victorian Volcanic Plain*.

Spiny Rice-flower

The Spiny Rice-flower population included 58 translocated individuals and a number of in-situ individuals located within the offset site. The translocated individuals were established during 2014-2017, translocated in three cohorts. Of the initial 58 individuals translocated, 28 were recorded as alive in the current monitoring period. Mitigation measures to prevent further population declines were recommended for the Year 6 monitoring period, including seed collection and germination and a watering regime.

Striped Legless Lizard

The population monitoring of Striped Legless Lizards resulted in 19 individuals being recorded within the offset site for Year 5. This is an increase in all previous monitoring years, with limited individuals observed in Years 1 and 2 (<5), 14 individuals in Year 3, and 18 in Year 4. The population appears to be stabilising, and will be continued to be monitored as a part of this program until the end of management in Year 10.

Natural Temperate Grassland of the Victorian Volcanic Plain

An assessment of the condition and extent of *Natural Temperate Grassland of the Victorian Volcanic Plain* (NTGVVP) was undertaken to observe any changes in the native vegetation cover and weed extent within the grassland. NTGVVP remained in good condition, with weed levels being actively managed to maintain at low levels. A controlled burn occurred in the eastern half of the offset site to reduce biomass accumulation of Kangaroo Grass *Themeda Triandra*, to allow for recruitment of other native grasses and herbs and improve native floristic diversity within the offset site.

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1 INTRODUCTION

1.1 Background

Ecology and Heritage Partners Pty Ltd was commissioned by VicTrack to undertake and oversee management and monitoring works for Year 5 relating to a 2.04 hectare conservation reserve area, and associated areas of retained grassland at the site of the Caroline Springs Railway Station, located on Christies Road, Caroline Springs (Figure 1).

The management, monitoring and auditing works required to be undertaken at Caroline Springs are detailed in the Conservation Management Plan (CMP) (Ecology and Heritage Partners 2014a) and Offset Management Plan (OMP) (Ecology and Heritage Partners 2014b) prepared for the site, and approved by the Commonwealth Department of the Environment and Energy (DoEE) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC 2010/5463), and the Victorian Department of Environment, Land, Water and Planning (DELWP) (formerly the Department of Environment and Primary Industries [DEPI]).

Specifically, the works relate to the protection and ecological monitoring of the quality of the EPBC Act-listed community *Natural Temperate Grassland of the Victorian Volcanic Plain (*NTGVVP), weed and pest control works, biomass control methods such as prescribed ecological burns, and management and monitoring of the existing populations of the EPBC Act-listed Spiny Rice-flower *Pimelea spinescens* subsp. *spinescens* and Striped Legless Lizard *Delma impar*.

Ecology and Heritage Partners subcontracted Western Land Services Pty Ltd (WLS) in June 2014 to implement pest plant and animal control, biomass reduction, revegetation and fencing works for the ecological management works between Years 1-4. WLS were contracted directly by VicTrack for Year 5 works.

The Year 5 annual monitoring report presented below outlines the management and monitoring actions undertaken throughout the conservation area (referred to herein as the offset site) and the other area of retained grassland between 1 July 2018 and 30 June 2019 (i.e. fifth year of the overarching CMP and OMP), with the beginning of Year 1 being 24 June 2014 (being the date of approval of the CMP and OMP) (Figure 2). The monitoring report for Year 1, Year 2, Year 3, and Year 4 is detailed in Ecology and Heritage Partners (2015; 2016; 2017; 2018a). The methods utilised for the monitoring and management actions follow those set out in the CMP (Ecology and Heritage Partners 2014a) and the OMP (Ecology and Heritage Partners 2014b).

Sections 2.1 predominately relate to the monitoring and management of the Spiny Rice-flower as prescribed by the CMP, Section 2.2 relates to the Striped Legless Lizard population and habitat monitoring, while Section 2.3 relates to the monitoring and management of the offset site as a whole as required by the OMP.

1.2 Objectives

The objective is to monitor and manage the biodiversity at the Caroline Springs Railway Station in accordance with EPBC 2010/5463 and the Commonwealth approved CMP and OMP (Year 5), between January and June 2019.

The methodology focuses on biodiversity monitoring of the quality of the EPBC Act-listed community Natural Temperate Grassland of the Victorian Volcanic Plain (NTGVVP), weed and pest control works, biomass control methods such as prescribed ecological burns, and monitoring of the Spiny Rice-flower *Pimelea spinescens* subsp. *spinescens* population. Habitat and population monitoring of Striped Legless Lizard was completed in the first half of the Year 5 monitoring (July – December 2018).

On-ground monitoring surveys will be undertaken, with an overall objective to provide a framework for the continuation of the management, auditing and reporting required to be undertaken as part of the approved CMP and OMP as per EPBC 2010/5463, to ensure the enhancement of the 2.04 hectare offset area, and other areas of retained grassland at the Caroline Springs Railway Station.

1.3 Scope of Works

Review of EPBC 2010/5463, OMP and CMP requirements

Ecology and Heritage Partners will review the ongoing obligations required as part of the existing approvals, and ensure the proposed monitoring protocols and schedule have been designed to ensure that all relevant approval conditions are, and can be achieved. This report details if targets are being met as per the management actions outlined in the OMP and if management actions are required.

Spiny Rice-flower Monitoring

- Monitoring of translocated Spiny Rice-flower within the offset site will be conducted in accordance with the recommended monitoring protocol for transplanted individuals detailed in Vallee *et al*. (2004).
  - Established translocated recipients monitored in January and April 2019;
  - Attributes including growth, sex, virility (percentage of plant in flower), recruitment, health and survival rates will be undertaken;
  - A sample of 25 of the existing *in-situ* plants in the offset site will be monitored concurrently to compare growth, survival and recruitment with that of the transplants.
- To mitigate the threat of drought stress, particularly between January – April 2019, the translocated Spiny Rice-flower will be watered monthly in accordance with the regime summarised in Table 1.

Table 1 – Watering requirements for replanted salvaged material.

Months after planting	Period between significant rainfall events that will trigger watering	Watering Required
0-3	1 week	Weekly
3-9	3-4 weeks	Fortnightly
9 - 21	1 – 2 Months	Monthly

- Biomass adjacent to each transplanted Spiny Rice-flower will be subject to ongoing hand-weeding activity during each monitoring and/or watering event to ensure sufficient inter-tussock space is maintained to encourage growth.
- Ongoing maintenance of tags/labels for marked Spiny Rice-flower. Tags will be replaced if required;

- Following the monitoring, a final report for Year 5 covering monitoring between January – June 2019 will be produced in June 2019 summarising the current population status and the condition of their habitat.

Striped Legless Lizard

Monitoring of the Striped Legless Lizard population occurred in the Year 5 July – December 2018 report (Ecology and Heritage Partners 2018).

Natural Temperate Grassland of the Victorian Volcanic Plain

- Monitor the quantity and quality of native grassland within the offset area during April 2019.
    - Surveys (Habitat Hectare assessment) will be structured around biomass reduction activities;
    - Fixed photo points will be utilised in areas of both intact vegetation and those dominated by weeds in order to also visually record any successive changes;
    - Surveys will focus on the quality and structure of remnant grassland as suitable habitat for Striped Legless Lizard (SLL) and Spiny Rice-flower (SRF), and also whether the cover of native species is retained and or enhanced by ongoing management.
- Conduct regular monitoring for high threat weeds, with the aim of eventual elimination of all woody weeds (currently approx. 1% cover) and reduction of herbaceous weeds to at or below 10% cover (currently approx. 20%.);
- High threat weeds including Serrated Tussock *Nassella trichotoma*, Paterson's Curse *Echium plantagineum* and Artichoke Thistle *Cynara cardunculus* are present within the offset area. The cover and distribution of weeds will be mapped and described, with management recommendations included to inform ongoing weed control works.

Monitor survivorship of planted herbs

Approximately eight species of herbs (comprising a total of 436 specimens) were planted in August 2017 to assist in increasing floristic diversity within the offset site. Additional herbs were planted in September 2018.

Survivorship of the herbs will be monitored during April 2019. Where survivorship drops below 80%, supplementary planting will be required to replace those specimens that have perished.

1.4 Vegetation and Site Condition

Biomass across the offset site is relatively dense, with vegetation condition ranging from moderate to high due to the overall low cover of high threat weeds and mixture of native herbs and grasses present. The western half of the offset site was subject to an ecological burn in June 2018, and although biomass was significantly reduced compared to the remainder of the site, annual weeds flourished in the open spaces created by the burn, with Wild Oat *Avena fatua* becoming the dominant species present during early-mid Spring (Plate 1). The most recent site inspection, undertaken on 19 June 2019, noted that the cover of Wild Oat had significantly reduced in the burnt area, and that the native grasses were recovering and are now the dominant species present in the area (Plate 2).

The eastern section of the offset site is dominated by a thick covering of Kangaroo Grass *Themeda triandra* and a narrow band of Kneed Spear-grass *Austrostipa bigeniculata* occurs along the eastern fence. A range of native herbaceous flora species persist throughout this section, including the nationally significant Spiny Rice-flower, Curved Rice-flower *Pimelea curviflora,* Slender Bindweed *Convolvulus angustissimus* subsp. *omnigracilis*, Cotton Fireweed *Senecio quadridentatus*, Narrow-leaf Plantain *Plantago gaudichaudii*, Berry Saltbush *Atriplex semibaccata*, Cotton Fireweed *Senecio quadridentalis*, Common Woodruff *Asperula conferta*, and Plains Candles *Stackhousia subterranean*. In addition to Kangaroo grass, other native grasses occur in low abundances, including Rigid Panic *Walwhalleya proluta*, Windmill Grass *Chloris truncata*, Common Wallaby-grass *Rytidosperma caespitosa* and the State-significant Rye Beetle-grass *Tripogon loliiformis*. Weed cover within this eastern section is relatively low, with Wild Oat and Rye-grass *Lolium* sp. being common species, primarily close to the fence boundary and around the translocation recipient site.

Plate 1. Introduced grass, Wild Oat, was prevalent in the western section of the offset site where the ecological burn occurred (Ecology and Heritage Partners 9/11/2018)

Plate 2. Western section of offset site (burnt) where native grasses are recovering, and exotic grass has declined (Ecology and Heritage Partners 14/06/2019)

Weeds of national significance are present, including Chilean Needle-grass *Nassella neesiana,* Serrated Tussock *Nassella trichotoma* and African Box-thorn *Lycium ferocissimum.* These species were previously present in low abundance, and recent weed management work has further reduced the cover abundance of these two species across past management years. No individuals of African Box-thorn were observed in the recent site inspection. Other weed species present throughout the offset site and retained grassland include Wild Oat, Galenia *Galenia pubescens* var. *pubescens,* Spear Thistle *Cirsium vulgare,* Common Sow-thistle - *Sonchus oleraceus*, Patterson's Curse *Echium plantagineum* and Artichoke Thistle *Cynara cardunculus.*

Three habitat zones of differing quality were recorded in the offset site (Figure 2). Habitat zone PG1 was present along the eastern boundary of the offset site and is dominated by Kneed Spear-grass, with a low diversity of other grasses and herbs. Zone PG2 is located in the eastern half of the offset site and is dominated by Kangaroo Grass, but also contains occurrences of Kneed Spear-grass, Wallaby-grasses, Windmill-grass, and a wide range of herbs within the understory. Weed cover is relatively low in this habitat zone. Habitat zone PG3, present across the western half of the offset site comprises a similar species composition to PG2. Condition scores for each habitat zone were reassessed in June 2019 using the Habitat Hectares methodology (DSE 2004), where the condition of the site is compared against the related

benchmark Ecological Vegetation Class provided by DELWP (2019) (Plains Grassland *Heavier soils* EVC 132) and results are presented in Appendix 1.

1.5 Security

Condition 1 of the EPBC Act approval specifies that the land identified in Annexure 1 of approval 2010/5463 (the protected land) adjacent to the clearing site must be protected in perpetuity to compensate for impacts to the nationally significant ecological community *Natural Temperate Grassland of the Victorian Volcanic Plain* (NTGVVP), Spiny Rice-flower and Striped Legless Lizard using a conservation covenant under the *Victorian Conservation Trust Act 1972*. This conservation covenant was agreed between the Public Transport Development Authority and Trust for Nature (TfN) and signed on 27 June 2014.

The Offset Annual Report (Year 5) prepared by VicTrack (site reference: TFN-C1723) was submitted to Trust for Nature in May 2019, as required by the Offset Management Plan.

The offset site is a total of 2.04 hectares, comprising 1.92 hectares of Plains Grassland vegetation, and 0.12 hectares of exotic vegetation.

2 ANNUAL REPORT 2019

2.1 Spiny Rice-flower Monitoring

Monitoring is required of both the status of the translocated Spiny Rice-flower (SRF) population within the designated recipient site, and a sample of the existing *in-situ* population and their habitat for a period of ten years within the offset site (Figure 4a). Monitoring will determine if management actions to improve habitat are suitable for the longevity of a viable Spiny Rice-flower population and determine when remedial actions are required.

2.1.1 Monitoring Methods

Long-term independent monitoring of translocated plants within the recipient site (Figure 4b) is crucial to ensuring ongoing survival (Vallee *et al.* 2004). Monitoring must be undertaken in accordance with the current PSRT protocols (PSRT 2013) which are summarised in Section 8 of the CMP (Ecology and Heritage Partners 2014a).

Monitoring was undertaken by a qualified botanist, familiar with the ecology and growth habits of Spiny Rice-flower. The site was visited twice, once in January 2019 and again in April 2019, during the remaining Year 5 management period.

As detailed in Section 8.8.1 of the CMP, Spiny Rice-flower monitoring is to occur every six months, provided site condition remains similar. However, due to the dry summer period in early 2019, it was considered appropriate to conduct the subsequent monitoring earlier than the required six-month period to observe the effects of drought and enable appropriate management response if required (i.e. watering).

To ensure that monitoring provided an accurate and ongoing assessment of the health of the translocated plants, the following variables were measured on each plant (where able):

- Sex (Male or Female);
- Presence of flowering material and percentage of the plant in flower;
- Growth;
- Survival;
- Presence of germinants (recruitment); and,
- Health.

In addition to the indicators of growth and reproductive success, monitoring looked at drought stress, pest plant and animal impacts, biomass and other site disturbances that may negatively impact the translocated plants.

A subset of 25 individuals from the existing *in* situ SRF population was monitored concurrently with the translocated specimens.

2.1.2 Recipient Site Conditions

As the recipient site is located near the entrance to the offset site and the carpark for Caroline Springs Railway Station, the potential for disturbance is therefore higher due to access issues. As such, a 2 metre tall fixed wire fence has been built adjacent to the railway station site to discourage unintended access by vehicles entering the offset site (Plate 3).

Kangaroo Grass is dominant within the recipient site, with a low cover of Kneed Spear-grass *Austrostipa bigeniculata* and Windmill Grass. However, relative to other areas within PG2 elsewhere within the offset site, the recipient site contains low levels of exotic grasses and herbs including Wild Oat, Rye-grass and Common Sow-thistle. The majority of perennial weeds having been eliminated over Years 1 to 5 due to regular herbicide treatment. No 'floating rock' is present within the recipient site, and no rocks were disturbed or removed as part of the translocation process. Maintenance of Spiny Rice-flower labels was undertaken to ensure that all numbers were visible, or re-labelled where faded. Damaged or missing labels were replaced.

A remnant population of Spiny Rice-flower is present along the southern boundary of the recipient site, and care was taken to ensure these plants were not disturbed as part of the translocation, along with ongoing monitoring and management activities.

Overall, due to the ongoing weed control taking place, the recipient site is considered to be in good condition (Plate 4). Photo points of the offset site, including the recipient site, are included in Appendix 3, with locations shown in Figure 5.

Plate 3. Fence in good condition with appropriate signage (Ecology and Heritage Partners 14/06/2019).

Plate 4. Good quality vegetation and healthy Spiny Rice-flower in offset site (Ecology and Heritage Partners 14/06/2019)

2.1.3 Plant Deaths and Disturbances

June 2014 Transplants

As part of the most recent monitoring event of Year 5 (19 June 2019), there were no additional deaths during Year 5 from the previous mid-Year 5 results of the original 23 SRF salvaged specimens (June 2014 transplants). The 14 alive specimens remain in varying health conditions, from poor to excellent condition (Appendix 2). Of this cohort of SRF transplanted individuals, six (6) specimens perished in Year 1, with no

plant deaths in Year 2 or Year 3, and three plant deaths recorded during Year 4 (Table 2).

Table 2. Survival rate compared to initial number translocated for the 2014 SRF cohort

	Year 1	Year 2	Year 3	Year 4	Mid-Year 5	Year 5
Survival rate compared to initial number translocated	17/23	17/23	17/23	14/23	14/23	14/23

June 2015 Transplants

As of 19 June 2019, there were no additional deaths recorded during the final Year 5 assessment when compared to the mid-Year 5 from the original 32 SRF salvaged specimens (June 2015 transplants). In total, 19 of the 32 SRF specimens transplanted in June 2015 appear dead (12 SRF deaths in Year 2), and the remaining 13 specimens in moderate condition (Table 3; Appendix 2).

Two specimens (# 41 and 51) that were recorded as dead in Year 3, and alive in Year 4, were recorded as dead in the most recent assessment. It is likely that drought stress was a major factor in the loss of these specimens.

The majority of the living specimens were recorded in moderate to good health, showing signs of new growth. Watering during times dry conditions will improve the survival rate of these individuals into the future (refer to Section 2.1.6)

Table 3. Survival rate compared to initial number translocated for the 2015 SRF cohort

	Year 1	Year 2	Year 3	Year 4	Mid-Year 5	Year 5
Survival rate compared to initial number translocated	32/32	20/32	18/32	15/32	13/32	13/32

June 2017 Transplants

Of the three specimens transplanted in June 2017, only one remains alive (# 56) (Table 4). It is likely that the two dead specimens perished due to drought stress during the summer of 2017/2018. The remaining alive one has maintained a stable health score over monitoring events and was flowering in the most recent assessment.

Table 4. Survival rate compared to initial number translocated for the 2017 SRF cohort

	Year 1 (20142015)	Year 2 (2015/2016)	Year 3 (2016/2017)	Year 4 (2017/2018)	Mid-Year 5 (2018)	Year 5 (2019)
Survival rate compared to initial number translocated	na	na	3/3	3/3	1/3	1/3

In-situ monitoring

All 25 in-situ SRF specimens are in moderate to good condition during June of Year 5 despite not being subject to the watering regime applied to the translocated plants. Individuals in the eastern portion of the offset area are having to compete with a high cover of Kangaroo Grass, which is scheduled to be burnt when possible.

2.1.4 General Health and Growth

The health of all SRF plants was assessed at each monitoring event in accordance with the metric detailed in Table 5.

Table 5. Health Rating Metric for Spiny Rice-flower

Health Rating	Description	Health Indicator
1	Excellent	Less than 5% dieback
2	Good	Between 15 < 30% dieback
3	Moderate	Between 30 < 75% dieback
4	Poor	Between 75 < 99% dieback
5	Dead	No evidence of live biomass

2.2.4.1 June 2014 Transplants

Of the 14 plants (of the original 23) to survive Year 5, nine are in moderate to good health (i.e. – a health score between 1-3 [Figure A4]), with five specimens in poor health (score of 4) as of 19 June 2019.

Thirteen of the 14 plants were flowering during the final survey conducted in June (Plate 5; Plate 6), however no germinates were recorded during the June monitoring event. New shoots of regrowth were observed sprouting from the base of most plants, suggesting that the plants are successfully established and stabilised.

June 2015 Transplants

Of the 13 plants (of the original 32) to survive Year 5, eight are in good health (i.e. – a health score between 1-3), as of 19 June 2019.

Twelve were flowering during the June monitoring event, with a small number of germinates observed.

June 2017 Transplants

Only one specimen (#56) from the 2017 cohort was alive during the most recent monitoring event (19 June 2019). No germinants were recorded, and the alive specimen was in moderate health with only a small percentage of flowering material recorded.

Plate 5. Flowering Spiny Rice-flower within recipient site (Ecology and Heritage Partners 14/06/2019).

Plate 6. Flowering Spiny Rice-flower (Ecology and Heritage Partners 19/06/2019).

2.2.4.4 General Comments

Overall, the Year 5 results indicate a stable level of survivorship when compared to the earlier mid-Year 5 monitoring, and previous Year 4 monitoring, with a total of three specimens perishing between the Year 4 and Year 5 (July – Dec 2018) monitoring events, and no additional deaths between the mid and final Year 5 assessment. Throughout the summer of the Year 5 monitoring event, regular watering occurred of the transplanted individuals to reduce the threat of drought stress. Watering events were undertaken during prolonged periods of dry, hot weather, between November 2018 and April 2019.

Of the 58 SRF transplants, 29 specimens were alive during the most recent monitoring event.

The number of deaths occurring between years is decreasing as the plants become more established within the recipient site, with the surviving individuals within the main two transplant cohorts (2014 and 2015) appearing in moderate to excellent health.

Summaries of the 2019 recorded data for the monitoring of January – June 2019 of Year 5 are presented in Appendix 2 and a photo of each translocated individual is provided in Appendix 4.

2.1.5 Threatening Processes

Weed invasion, biomass accumulation and drought stress present the greatest threats to the health and survival of translocated plants at the recipient site. In all cases, remedial actions to mitigate these threats were undertaken throughout the monitoring period, and these actions are summarised below in Section 2.3. Drought stress was observed in some Spiny Rice-flower individuals during the summer of 2018/2019, which

triggered a hand-watering management response. The plates below show how hand watering can improve the health of a translocated individual (Plate 7; Plate 8).

Weeds such as Serrated Tussock, Common Sow-thistle, Patterson's Curse and Spear Thistle, and native grasses including Kangaroo-grass have the potential to out-compete or smother translocated Spiny Rice-flower plants and prevent recruitment. However, ongoing weed control, biomass removal and implementation of the watering regime are anticipated to continue to mitigate these threats as the translocated plants further establish.

Plate 7. Evidence of drought stressed Spiny Rice-flower that triggered hand-watering response (Ecology and Heritage Partners 2019).

Plate 8. Hand-watering during periods of drought stress ensures Spiny Rice-flower survival (Ecology and Heritage Partners 2019).

2.1.6 Management Actions

The current main threat to the translocated Spiny Rice-flower population is drought stress and biomass accumulation by the surrounding Kangaroo Grass and exotic grasses. To manage drought stress, translocated individuals were hand watered during periods of hot, dry weather, with a minimum of three litres applied to each individual. Ongoing control of high threat weeds, such as Serrated Tussock, has reduced the risk to the Spiny Rice-flower population. Biomass control around the Spiny Rice-flowers is undertaken at each monitoring event by Ecology and Heritage Partners, where hand weeding occurs around the individuals. This opens up inter-tussock spaces, reduce competition for resources and space, and encourage growth and establishment. Western Land Services also conducted selective herbicide application on those high-threat weeds within the recipient site and surrounds (with a particular focus on Serrated Tussock, thistles, and Patterson's Curse) that have a higher potential to impact the Spiny Rice-flower population, but avoid the use of herbicides within close proximity to Spiny Rice-flower individuals.

An ecological burn was conducted in June 2018 in the western section of the offset site. Additional details are provided in the Year 4 annual report (Ecology and Heritage Partners 2018).

As per the contingency measures detailed in the CMP (Ecology and Heritage Partners 2014a), seed was collected from translocated SRF following the 2018 flowering season by WLS. Collected seed will be used for

propagation purposes should the performance targets specified in the CMP at the end of Year 5 (June 2019) not be met, and the contingency plan is enacted.

Performance Targets

The ultimate aim of translocation is to ensure the conservation of the genetic diversity of a species. The conservation of genetics is especially critical for endangered species and the loss of genetics from even a single plant can be seen as a failure of the translocation process.

Vallee *et al.* (2004) and the PsRT have detailed stringent criteria for determining the success of translocated plant species. The outlined criteria are detailed in the CMP.

In order to meet the short-term performance target of 50% survival, a total of 28 plants should be alive at the end of Year 5. As of mid-Year 5, 29 plants are alive (with 6 lost in Year 1, 12 lost in Year 2, 2 lost in Year 3 and 6 lost in Year 4 and 6 lost plus one revival in Year 5 (July-Dec)). The final survival count for the end of Year 5 maintained the same 29 plants.

Monitoring indicated that the condition and structure of habitat within the recipient site, and offset site in general remains in good condition for Spiny Rice-flower persistence and no trigger values were exceeded for any of the measured habitat components.

Frequent monitoring for cracks around each 'plug', ongoing weed control and additional watering during the summer months should continue to ensure the population does not decline. Due to the population barely meeting the 50% minimum performance target, it would be practical to germinate any previously collected seed and grow replacement plants in case future monitoring events see further decline in the species. By germinating individuals now, it will allow time for individuals to grow in a nursery environment, and be hardened off for survival, to ensure they are ready to be introduced into the population.

Continued monitoring in line with the CMP will ensure habitat for the Spiny Rice-flower and survival rates for translocated and *in-situ* individuals is maintained or improved within the site over the coming years.

2.2 Striped Legless Lizard monitoring

Monitoring is required for both the status of the Striped Legless Lizard population and their habitat for a period of ten years within the offset site (Figure 3). Monitoring of the Striped Legless Lizard population was undertaken during the first half of the Year 5 monitoring, and results are presented in the mid-Year 5 report (Ecology and Heritage Partners 2018b) and below.

2.2.1 Population Monitoring Results

A total of 19 Striped Legless Lizard (SLL) captures were recorded within the study area during targeted surveys (Plate 9) (Table 6). This is in contrast to Years 1 and 2 when no more than three individuals were observed during the targeted surveys, Year 3 where a total of fourteen individuals were recorded and Year 4 where a total of 18 were recorded. These results suggest an increasing trend in the overall population size for the study area. It is possible that some of the individuals recorded during Year 5 were recaptures.

Table 6. Summary of Striped Legless Lizard surveys

Note. SLL = Striped Legless Lizard; EBT = Eastern Blue-tongue.

Date	Observer	Time	Air Temp	Cloud Cover	Wind Direction and Spd	Above Tile Temp	Under Tile Temp	Grid 1 (east)	Grid 2 (west)
10/08/2018	TR/EH	11.40	18	70%	WNW (12km/hr)	15.2	14.8	**1 x SLL**, 2 x EBT	1 x House Mouse
25/09/2018	TR/AW	12:10	11	90%	SSE (20 km/hr)	15.4	13.2	**3 x SLL**, 3 x EBT	**1 x SLL**
11/10/2018	TR	10:15	15.5	5%	ESE (7 km/hr)	43.3	36.9	**5 x SLL**, 1 x EBT	**1 x SLL**
23/10/2018	TR	11:45	15.2	60%	SW (26km/hr)	23.6	19.5	**2 x SLL**, 4 x EBT	**1 x SLL**
09/11/2018	TR	12:30	16.7	80%	W (20km/hr)	27.8	24.3	**3 x SLL**, 2 x EBT	**2 x SLL**
05/12/2018	EH	10:35	17	5%	SE (20km/hr)	36.2	30.7	1 x EBT	-

The common rodent species House Mouse *Mus musculus* and Eastern Blue-tongue *Tiliqua scincoides* were also recorded in the study area during tile grid checks (Plate 10). No other vertebrate fauna species of note were recorded during targeted surveys.

Plate 9. Grid 1 – Striped Legless Lizard (Ecology and Heritage Partners 11/10/2018)

Plate 10. Grid 1 – Eastern Blue-tongue (Ecology and Heritage Partners 11/10/2018)

2.2.2 Habitat monitoring results

Monitoring of Striped Legless Lizard habitat was undertaken in accordance with Section 8.8.2 of the CMP (Ecology and Heritage Partners 2014a) and results are presented in this report.

The CMP details the requirements for Striped Legless Lizard habitat rehabilitation and management. For each habitat variable, the recorded value must be compared to the trigger value to determine if a management response is triggered and the nature of the response required. Table 7 summarises the monitoring categories and trigger thresholds for Striped Legless Lizard monitoring, while Table 8 summarises the results of Year 5 habitat monitoring. One trigger value was exceeded, the cover of introduced grass, which is discussed in more detail below (Section 2.2.3). No additional values were triggered, and therefore no further specific management response is required following Year 5 of Striped Legless Lizard habitat monitoring.

Table 7. Striped Legless Lizard habitat monitoring criteria

Habitat variable	Ideal level^	Trigger level for action	Response if triggered	Response Triggered?*
Native clumping grass cover	50%	<30%	Plant native clumping species	**No**
Introduced grass cover	<10%	>20%	Remove weeds	**Yes***
Bare ground	20%	<5%	Removal of vegetation	**No**
		>50%	Plant native clumping species	**No**
Exposed rock	10%	<5%	Removal of vegetation	**No**
Inter-tussock spacing	30 centimetres	<10 cms	Removal of vegetation	**No**
		>50 cms	Plant native clumping species	**No**

Note: ^The ideal level value is the average value for each tile grid. * Refer to Table 8 for further information.

Table 8. Striped Legless Lizard habitat monitoring results

Habitat Variable	Grid 1 (East)					Grid 2 (West)					Response Triggered
	Q 1	Q 2	Q 3	Q 4	Average	Q 1	Q 2	Q 3	Q 4	Average	
Native clumping grass cover	75%	70%	70%	75%	**72.5%**	30%	30%	50%	70%	**45%**	**No**
Introduced grass cover	10%	15%	10%	5%	**10%**	30%	30%	15%	10%	**21.25%**	**Yes***
Bare ground	10%	5%	20%	10%	**11.25%**	35%	15%	40%	25%	**28.75%**	**No**
Exposed rock	10%	10%	5%	5%	**7.5%**	5%	5%	10%	5%	**6.25%**	**No**
Inter-tussock spacing	10 cm	10 cm	10 cm	10 cm	**10 cm**	50 cm	40 cm	40 cm	35 cm	**41.25 cm**	**No**

**Note: ***A specific management response is not considered to be required (see Section 2.2.3); Q1 and Q2 results are from mid-Year 5 monitoring report (July – December) (Ecology and Heritage Partners 2018). Q3 and Q4 are from the current monitoring period.

2.2.3 Conclusion

Striped Legless Lizard habitat monitoring indicated that habitat within the offset site has generally improved in condition, with an increase in native tussock cover and a decrease in introduced grass cover over the course of the monitoring period. Despite this, thresholds for one management action was triggered, due to the introduced grass cover in Grid two. This is due to the high cover of introduced grass that was recorded after the burn that occurred in June 2018, however, native species within this area are recruiting and supressing introduced grasses, as evident in the final monitoring results, where the introduced grass cover in Grid two declined from 30% to 10%, and is likely to continue to decline as the native grasses recover and ongoing weed management continues. As a result, the current weed management approach is likely to achieve the target levels set out in the CMP, noting that seasonal fluctuations in weed cover occur and that burns will impact the short term cover of weeds until the seed bank is depleted of exotic seed. Ongoing weed management following the recommended methods in the CMP will lead to a decrease in stored seed, and overall decrease in weeds within the offset site.

The inter-tussock spacing between native grasses in the western portion of the offset site is slightly higher than optimal levels, but is gradually filling in as the native species recover after the burn undertaken in June 2018 (Plate 11). The eastern portion of the offset area required an ecological burn, as the native grasses have a high biomass accumulation and reduced inter-tussock spacing (Plate 12). An ecological burn occurred in June 2019 (Western Land Services 2019).

Continual monitoring in line with the CMP will ensure habitat for Striped Legless Lizard is maintained or improved within the site over the coming years.

Plate 11. Inter-tussock spacing of western portion of offset area (Ecology and Heritage Partners 2019).

Plate 12. Inter-tussock spacing of eastern portion of offset area (Ecology and Heritage Partners 2019).

2.3 Management Actions for Year 5 (as per Table 12 of the OMP)

The following section relates to the management actions and targets summarised in Table 12 of the OMP prepared for the offset site (Ecology and Heritage Partners 2014b).

2.3.1 Undertake control of woody weeds

Timing of Action and key performance target

Before seed heads mature in summer. Ensure cover of woody weeds is <1%.

Status – Year 5

Action Completed. Western Land Services mechanically removed woody weed infestations during Year 1 and Year 2, with woody weed control works during Year 5 focussed on the controlling any emerging African Box-thorn recruits that were observed re-sprouting from previously removed infestations. Where present, emergent African Box-thorn was treated via cut and paint method, herbicide (Tricopyr).

Based on the removal of existing infestations within the offset site and areas of retained grassland, woody weed cover is now considered to be at approximately <1%.

Actions Required

The performance target for the cover of woody weeds is being met. Due to the existing stored soil seedbank, further monitoring and control will be required over the coming years to ensure additional woody weed infestations do not re-establish within the site.

2.3.2 Undertake control of exotic grasses and herbaceous broadleaves

Timing of Action and key performance target

Before seed heads mature in spring/summer. Reduce perennial grass cover <5%, and annual grasses/broadleaves <5%.

Status – Year 5

Action Completed

Western Land Services have undertaken measures to control exotic grasses within the study area, primarily through targeted management actions for Serrated Tussock, Spanish Artichoke and Paterson's Curse. WLS have also spread native grass seeds throughout burnt areas within the site, to encourage native grass establishment and reduce the cover of exotic species.

Actions Required

There is a low cover of exotic grasses and herbaceous broadleaves within the offset site. After the ecological burn in the western half of the study area, Wild Oat was noted to flourish, but has since died down with native tussocks re-establishing and naturally out-competing exotic grasses. This western area should be monitored to ensure the native grasses continue to re-establish and that exotic grass cover is maintained in low densities. In addition, spot spraying within this area should be undertaken to manage any emerging herbaceous broadleaf species and high threat grasses, such as Serrated Tussock.

Within the broader offset area, the site formerly contained large infestations of Serrated Tussock throughout. Much of the Serrated Tussock has been successfully treated, and Year 5 efforts focussed on monitoring for, and treating new infestations. Exotic grasses were sprayed multiple times with Glyphosate bi-active and selective herbicide was used for Broadleaf weeds, particularly Patterson's Curse, Oxtongue, Galenia and Brassica.

Future management of annual grasses within the offset site should be re-visited in consultation with the management contractor to determine an appropriate technique to successfully reduce the cover of annual grass within the offset site.

2.3.3 Conduct Rabbit Control

Timing of Action and key performance target

Peak breeding season: late summer/early autumn. Significant reduction in number/signs of rabbits

Status – Year 5

Action Completed

All harbour has been removed from the site during Year 1. No damaged as a result of pest animal activity was observed in Year 5 of monitoring with the pest-animal proof fence appearing to be successfully excluding pest fauna from the offset site.

Actions Required

Continued monitoring for the presence of pest fauna during the remainder of the 10 Year management plan is required. If pest fauna (rabbits, foxes) are observed, or signs thereof, appropriate control measures should be undertaken.

2.3.4 Maintain Perimeter Fence

Timing of Action and key performance target

Ongoing; Fence is maintained and repaired if broken.

Status – Year 5

Action Completed

Western Land Services and Ecology and Heritage Partners regularly check on the fencing during site visits. All fences and gates are currently in good order. No maintenance is currently required.

Actions Required

Continued monitoring of fence condition to ensure signage and the integrity of the pest fauna-proof fence is maintained during future monitoring events.

2.3.5 Undertake biomass reduction via mosaic burning/weeding in selected areas

Timing of Action and key performance target

Autumn; Areas of inter-tussock space opened up to allow for recruitment.

Status – Year 5

Action Completed

Hand weeding has been undertaken around all transplanted Spiny Rice-flower to ensure that the presence and/or recruitment of grasses do not limit the growth, or detrimentally impact the Spiny Rice-flower plants. This was undertaken by Ecology and Heritage Partners during the two monitoring visits, and also undertaken by Western Land Services during management visits.

An ecological burn was undertaken in winter 2019 in the eastern section of the offset area by Western Land Services. A previous ecological burn was undertaken in June 2018 in the western half of the offset area, with the aim of reducing biomass. Refer to the Year 4 report for further information (Ecology and Heritage Partners 2018).

Actions Required

Monitor recovery of native grasses in response to the recent burn undertaken. Continue weed control in areas subject to the ecological burn is required to reduce the prevalence of exotic flora within the eastern section of the offset site. Monitor the western section of the offset area for biomass accumulation as the area recovers form the ecological burn undertaken in June 2018.

2.3.6 Undertake supplementary planting of herbs

Timing of Action and key performance target

Herb plantings monitored in August 2018.

Status – Year 5

Action Completed

A total of 436 herbs were planted during Year 3, and an additional 200 during September 2018, with survivorship monitored in April 2019 (Plate 13; Plate 14). Overall survivorship of planted herbs is currently 85%. The herbs planted in September 2018 are in good condition, and established herbs from earlier plantings are in moderate to good condition.

Plate 13. Established supplementary herb plantings within the offset site (Ecology and Heritage Partners 2019).

Plate 14. Supplementary herb plantings within the offset site (Ecology and Heritage Partners 2019).

Actions Required

Survivorship of the planted herbs from the Year 3 and Year 5 cohort will require continual monitoring to ensure overall survival does not fall below 80%.

2.3.7 Monitor status of vegetation condition, Spiny Rice-flower and Striped Legless Lizard.

Timing of Action and key performance target

Progress report to the satisfaction of DELWP/DoEE

Status – Year 5

Action Completed

This report satisfies this requirement for the annual Year 5 report.

2.3.8 Removal of all existing rubbish from site

Timing of Action and key performance target

At least every 2 months. All rubbished removed and removed immediately if dumping occurs.

Status – Year 5

Action Completed

Western Land Services undertake bi-monthly inspections across the year to monitor and remove rubbish from the offset site and areas of retained grassland. Limited rubbish was present within the offset site during Year 5, with the high fence likely to prevent rubbish being dumped or blown from the adjacent carpark.

Actions Required

Continued monitoring of rubbish within the site, and immediate removal where appropriate during future years of management

3 CONCLUSION

Following the management and monitoring activities undertaken during Year 5 of the works as required under the approval conditions of EPBC 2010/5463, one trigger threshold has been activated for the habitat monitoring of Striped Legless Lizard, introduced grass cover. This threshold was triggered due to the high cover of introduced grasses that emerged from the stored seed bank after the burn that occurred in June 2018, however the introduced grasses have since died off as the native grasses have re-established. The burn has aided in depleting the exotic grass seed stored in the soil bank, and the germination of this seed, in conjunction with the removal of mature exotic grasses prior to new seed set, will lead to a decline in both the stored seed and mature individuals across the offset site over the long term. It should be noted that seasonal fluctuations in exotic grass cover will occur, where cover should be reviewed against previous covers during the same season to determine if an overall decline in exotic grass cover is occurring across the years (i.e. comparing cover on a broader time scale). Specific management is not required currently for introduced grasses, but the ongoing management will be required to ensure introduced grass cover does not increase in the future.

No other management responses, as identified in the CMP and OMP, were triggered, indicating that the current management method for ensuring the quality of the offset site is gradually improved is effective in meeting the current management objectives.

A total of 29 Spiny Rice-flower are alive out of the 58 specimens that have been transplanted to the recipient site. The survival target for Spiny Rice-flower of 50% survival at the end of Year 5 was achieved. No contingency measures are currently required to mitigate impacts to Spiny Rice-flower. However, due to the current population level sitting just above 50% survival, it is recommended that seed collected from Spiny Rice-flower in previous years is germinated to ensure plants are available to replace any further losses from the transplanted individuals. This will ensure the population numbers do not fall below 50%.

The condition of the offset site and retained grassland is good, with perennial and woody weeds intensively managed during Years 1-4, resulting in the current cover of these species exceeding or achieving the performance targets at the final Year 5 monitoring event. Ongoing management is required, with a select focus on controlling Serrated Tussock and Artichoke Thistle within the offset area.

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FIGURES

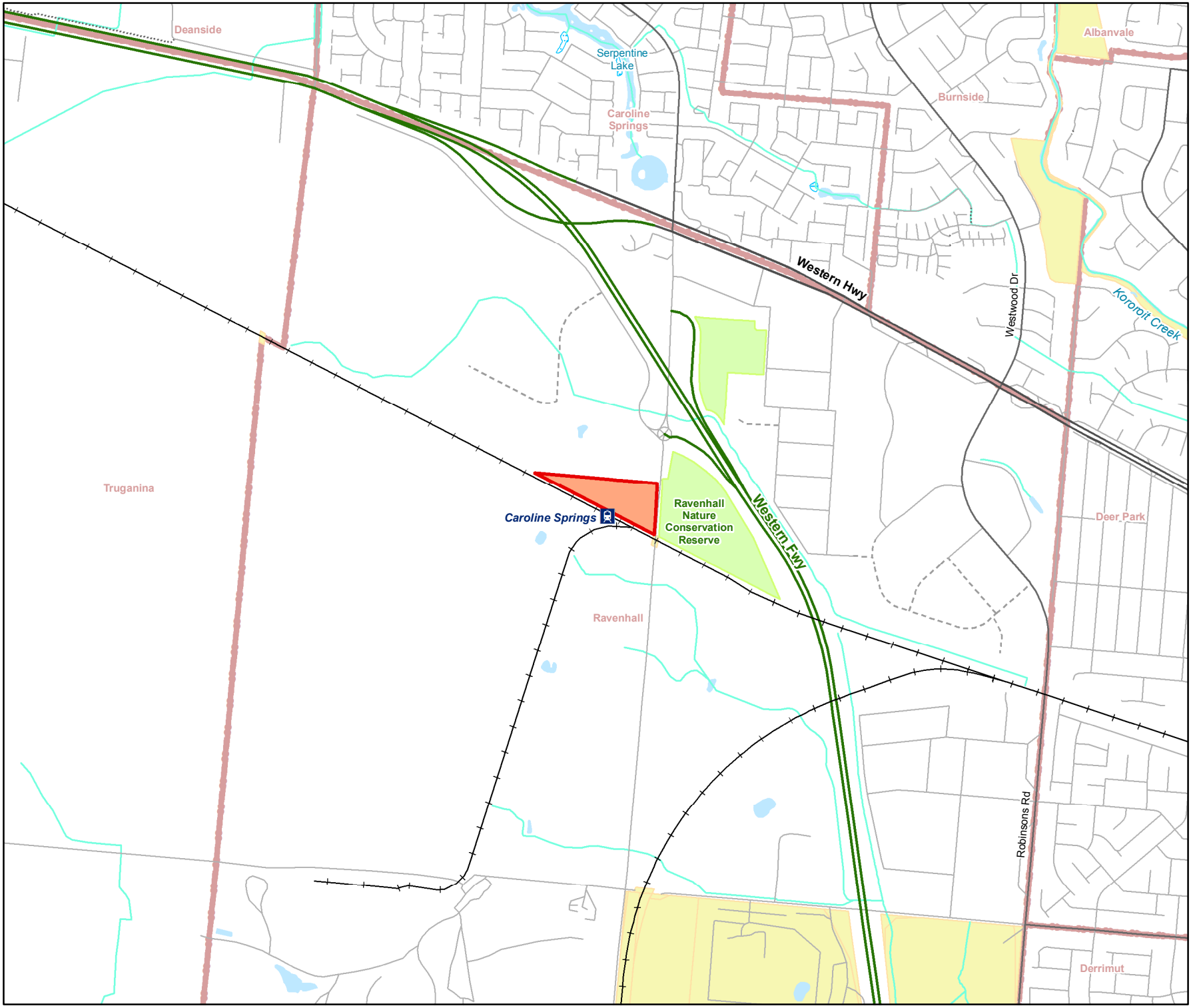

Figure 1

Location of the study area

Caroline Springs Year 5 (January - June 2019) Management

ecology & heritage partners

11846_f10961_Fig01_StudyArea 20/06/2019 lroy

Legend

- Offset site
- Spiny Rice-flower recipient site
- Plains Grassland / Retained areas of NTGVVP and SLL habitat
- Plains Grassland / Removed areas of NTGVVP and SLL habitat
- Lot boundary

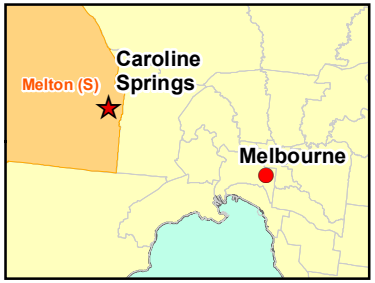

Figure 2

Ecological features and extent of NTGVVP and Striped Legless Lizard habitat

Caroline Springs Year 5 (January - June 2019) Management

N

0 25 50

Metres

ecology & heritage partners

Aerial source: Nearmap 2018

Legend

- Study Area
- Recorded Striped Legless (19 records in total)
- Tile grids

Figure 3

Striped Legless Lizard grid locations and records

Caroline Springs Year 5 (January - June 2019) Management

N

0 25 50

Metres

ecology & heritage partners

11846_Fig03_SLL_GridLoc 20/06/2019 lroy

Aerial source: Nearmap 2018

Legend

- Spiny Rice-flower recipient site
- Monitored *In-situ* Spiny Rice-flower
- Translocated Spiny Rice-flower (2017)
- Translocated Spiny Rice-flower (2015)
- *In-situ* Spiny Rice-flower population (August 2014)
- *In-situ* Spiny Rice-flower population (August 2015)
- Translocated Spiny Rice-flower (2014)
- Offset site
- Retained areas of Grassland

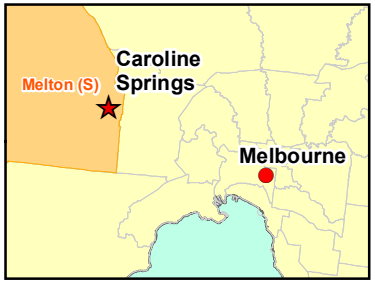

Figure 4a

Spiny Rice-flower recipient site, and monitored and translocated Spiny Riceflowers

Caroline Springs Year 5 (January - June 2019) Management

N

0 25 50

Metres

ecology & heritage partners

11846_Fig04a_SRF_RecipientSite 20/06/2019 lroy

Aerial source: Nearmap 2018

Figure 4b

Spiny Rice-flower recipient site, and monitored and translocated Spiny Riceflowers

Caroline Springs Year 5 (January - June 2019) Management

ecology & heritage partners

11846_Fig04b_SRF_RecipientSite 20/06/2019 lroy

Aerial source: Nearmap 2018

Legend

- Photo points
- Ecological burn 2018
- Offset site
- Spiny Rice-flower recipient site
- Herb plantings

Figure 5

Location of photo points and ecological burn

Caroline Springs Year 5 (January - June 2019) Management

N

0 15 30

Metres

ecology & heritage partners

11846_Fig05_Photopoints_Ecoburn 20/06/2019 lroy

Aerial source: Nearmap 2018

APPENDICES

Appendix 1. Habitat Hectare Assessment

Table A1.1. Habitat hectare assessment

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	5	15	10
	Lack of Weeds /15	9	9	6
	Recruitment /10	6	6	6
	Organic Matter /5	5	3	5
	Logs /5	na	na	na
	Treeless EVC Multiplier	1.36	1.36	1.36
	Subtotal =	34	44.88	36.72
Landscape Value /25		16	16	16
Habitat Points /100		50	61	40
Habitat Score		0.50	0.61	0.40

Note: Habitat zones are shown in Figure 2.

Appendix 2. Spiny Rice-flower Monitoring Data

A2.1. 2014/2015 Transplant Cohort – Annual Year 5 Status

Table A2.1. Sex and status of translocated Spiny Rice-flower.

Plant #	Sex	End of Year 5 Status	Flowering & per cent in flower	% Foliage	Heath score (1-5)	Germinants
#1	Female	Dead	-	-	-	-
#2	Male	Dead	-	-	-	-
#3	Female	Dead	-	-	-	-
#4	Female	Alive	0	1	4	0
#5	Female	Alive	5	25	3	0
#6	Female	Alive	55	10	2	0
#7	Female	Dead	-	-	-	-
#8	Female	Alive	5	30	4	0
#9	Female	Dead	-	-	-	-
#10	Male	Alive	5	15	4	0
#11	Male	Alive	2	15	4	0
#12	Male	Dead	-	-	-	-
#13	Female	Dead	-	-	-	-
#14	Female	Alive	40	65	2	0
#15	Male	Alive	60	65	3	0
#16	Male	Alive	10	30	4	0
#17	Male	Alive	20	50	3	0
#18	Female	Alive	20	70	3	0
#19	Male	Alive	1	20	3	0
#20	Male	Dead	-	-	-	-
#21	Female	Dead	-	-	-	-
#22	Female	Alive	20	50	3	0
#23	Male	Alive	40	65	2	0

A2.2. 2015/2016 Transplant Cohort – Annual Year 5 Data (Year 3 of CMP)

Table A2.2. Sex and status of translocated Spiny Rice-flower.

Plant #	Sex	End of Year 5 Status	% flowering	% Foliage	Heath score (1-5)	Germinants
#24	Male	Dead	-	-	-	-
#25	Male	Dead	-	-	-	-
#26	Female	Dead	-	-	-	-
#27	Female	Alive	20	60	3	0
#28	Male	Alive	30	75	2	0
#29	Female	Dead	-	-	-	-
#30	Male	Dead	-	-	-	-
#31	Male	Dead	-	-	-	-
#32	Female	Dead	-	-	-	-
#33	Male	Dead	-	-	-	-
#34	Male	Alive	40	80	1	0
#35	Female	Dead	-	-	-	-
#36	Male	Dead	-	-	-	-
#37	Female	Alive	5	60	3	0
#38	Male	Alive	10	30	4	0
#39	Female	Dead	-	-	-	-
#40	Male	Alive	70	85	1	0
#41	Male	Dead	-	-	-	-
#42	Female	Alive	15	60	3	0
#43	Male	Alive	40	75	2	1
#44	Female	Alive	15	60	2	1
#45	Male	Alive	1	10	4	0
#46	Female	Alive	0	1	4	0
#47	Female	Alive	5	15	4	0
#48	Male	Dead	-	-	-	-
#49	Male	Dead	-	-	-	-
#50	Male	Dead	-	-	-	-
#51	Male	Dead	-	-	-	-
#52	Female	Dead	-	-	-	-
#53	Female	Alive	30	60	4	0
#54	Female	Dead	-	-	-	-
#55	Female	Dead	-	-	-	-

Appendix 3. Photo points

2019 - Year 5 (Jan - June) Photo points

Plate A2.1. Photo point 1 (June 2019)

Plate A2.2. Photo point 2 (June 2019)

Plate A2.3. Photo point 3 (June 2019)

PlateA2.4. Photo point 4 (June 2019)

Plate A2.5. Photo point 5 (June 2019)

PlateA2.6. Photo point 6 (June 2019)

PlateA2.7. Photo point 7 (June 2019)

Plate A2.8. Photo point 8 (June 2019)

Plate A2.9. Photo point 9 (June 2019)

Plate A2.10. Photo point 10 (June 2019)

Appendix 4. Translocated Spiny Rice-Flower photos

All photos taken by Ecology and Heritage Partners (19/06/2019)

Plate A3.1. Transplant 1 (n/a)

Plate A3.2. Transplant 2 (n/a)

Plate A3.3. Transplant 3 (n/a)

Plate A3.4. Transplant 4

Plate A3.5. Transplant 5

Plate A3.6. Transplant 6

Plate A3.7. Transplant 7 (n/a)

Plate A3.8. Transplant 8

Plate A3.9. Transplant 9 (n/a)

Plate A3.10. Transplant 10

Plate A3.11. Transplant 11

Plate A3.12. Transplant 12 (n/a)

Plate A3.13. Transplant 13 (n/a)

Plate A3.14. Transplant 14

Plate A3.15. Transplant 15

Plate A3.16. Transplant 16

Plate A3.17. Transplant 17

Plate A3.18. Transplant 18

Plate A3.19. Transplant 19

Plate A3.20. Transplant 20 (n/a)

Plate A3.21. Transplant 21 (n/a)

Plate A3.22. Transplant 22

Plate A3.23. Transplant 23

Plate A3.24. Transplant 24 (n/a)

Plate A3.25. Transplant 25 (n/a)

Plate A3.26. Transplant 26 (n/a)

Plate A3.27. Transplant 27

Plate A3.28. Transplant 28

Plate A3.29. Transplant 29 (n/a)

Plate A3.30. Transplant 30 (n/a)

Plate A3.31. Transplant 31 (n/a)

Plate A3.32. Transplant 32 (n/a)

Plate A3.33. Transplant 33 (n/a)

Plate A3.34. Transplant 34

Plate A3.35. Transplant 35 (n/a)

Plate A3.36. Transplant 36 (n/a)

Plate A3.37. Transplant 37

Plate A3.38. Transplant 38

Plate A3.39. Transplant 39 (n/a)

Plate A3.40. Transplant 40

Plate A3.41. Transplant 41 (n/a)

Plate A3.42. Transplant 42

Plate A3.43. Transplant 43

Plate A3.44. Transplant 44

Plate A3.45. Transplant 45

Plate A3.46. Transplant 46

Plate A3.47. Transplant 47

Plate A3.48. Transplant 48 (n/a)

Plate A3.49. Transplant 49 (n/a)

Plate A3.50. Transplant 50 (n/a)

Plate A3.51. Transplant 51 (n/a)

Plate A3.52. Transplant 52 (n/a)

Plate A3.53. Transplant 53

Plate A3.54. Transplant 54 (n/a)

Plate A3.55. Transplant 55 (n/a)

Plate A3.56. Transplant 56

Plate A3.57. Transplant 57 (n/a)

Plate A3.58. Transplant 58 (n/a)