M2G Biodiversity Offset Monitoring Report

Spring 2015

Prepared for
Icon Water

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Abbreviations

Abbreviation	Description
BOM	Bureau of Meteorology
DBH	Diameter at Breast Height
DSE	Dry Sheep Equivalent
EIS	Environmental Impact Statement
ELA	Eco Logical Australia Pty Ltd
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)*
HBT	Hollow Bearing Tree
LMA	Land Management Agreement
M2G	Murrumbidgee to Googong Water Transfer Project
MU	Management Unit
ODP	Offset Delivery Plan
PER	Public Environment Report
RFAC	Regional Feral Animal Control
TSC Act	*Threatened Species Conservation Act 1995*

1 Introduction

1.1 Background

Eco Logical Australia Pty Ltd (ELA) was commissioned by Icon Water (formerly ACTEW Water) to deliver terrestrial ecology services as required by the environmental approval process for the Murrumbidgee to Googong Water Transfer Project (M2G).

The M2G projects falls under the jurisdiction of the Commonwealth Department of the Environment (previously, Department of Sustainability, Environment, Water, Population and Communities), NSW (Department of Planning), and ACT (ACT Planning and Land Authority) Governments and has been subject to assessment and environmental approval processes in all three jurisdictions. Project approval (granted in 2010) has been attained from all three governments, with a considerable number of approval conditions and commitments applied.

Under the environmental approvals process, Icon Water (conditioned as ACTEW Water) was required to provide compensatory habitat as an offset for vegetation and habitat losses arising from the construction activities for the M2G pipeline. The offset was required to be delivered to meet the conditions outlined in a range of documents including but not limited to, the Environmental Impact Statement (EIS) and Public Environment Report (PER) prepared for the development and relevant approval conditions.

1.2 Purpose of document

Under Condition 2.9b of the NSW Approval and Condition 3.1 of the Commonwealth approval conditions for the M2G Project (see Offset Delivery Plan (ODP) for further information), management and monitoring of the offset site is required. The ODP prepared by ELA (April 2012) describes the actions to be taken in establishing and managing the offset site according to the approval conditions and commitments, including the provision of monitoring actions (Eco Logical Australia 2012).

This report details the spring monitoring surveys for 2015 that were undertaken in accordance with the methodology and aims established in the ODP. It is designed to be a standalone monitoring report consistent with the format of the previous biannual monitoring reports, but also to relate to the ODP. The purpose of this document is to report on the ecological condition of the site and the management actions conducted throughout the previous year, in order to guide future actions within the offset site.

1.3 Study area

Icon Water own a land parcel in southern ACT (Block 1675), referred to here as the Williamsdale property (or 'the property'). The property is approximately 208 hectares in size and is located just south of Williamsdale. The property is bounded by the Monaro Highway to the east; the NSW border to the south; Angle Crossing Road to the north; and the Murrumbidgee River corridor to the west (**Figure 1**). The monitoring surveys were conducted within the offset site (study area of approximately 110 ha), which is wholly contained within the property.

The offset site has been set aside for conservation due to its high biodiversity value; including the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) listed White Box, Yellow Box, Blakely's Red Gum Grassy Woodland and Derived Native Grassland (Box-Gum Woodland), threatened flora and fauna species and/or threatened species habitat.

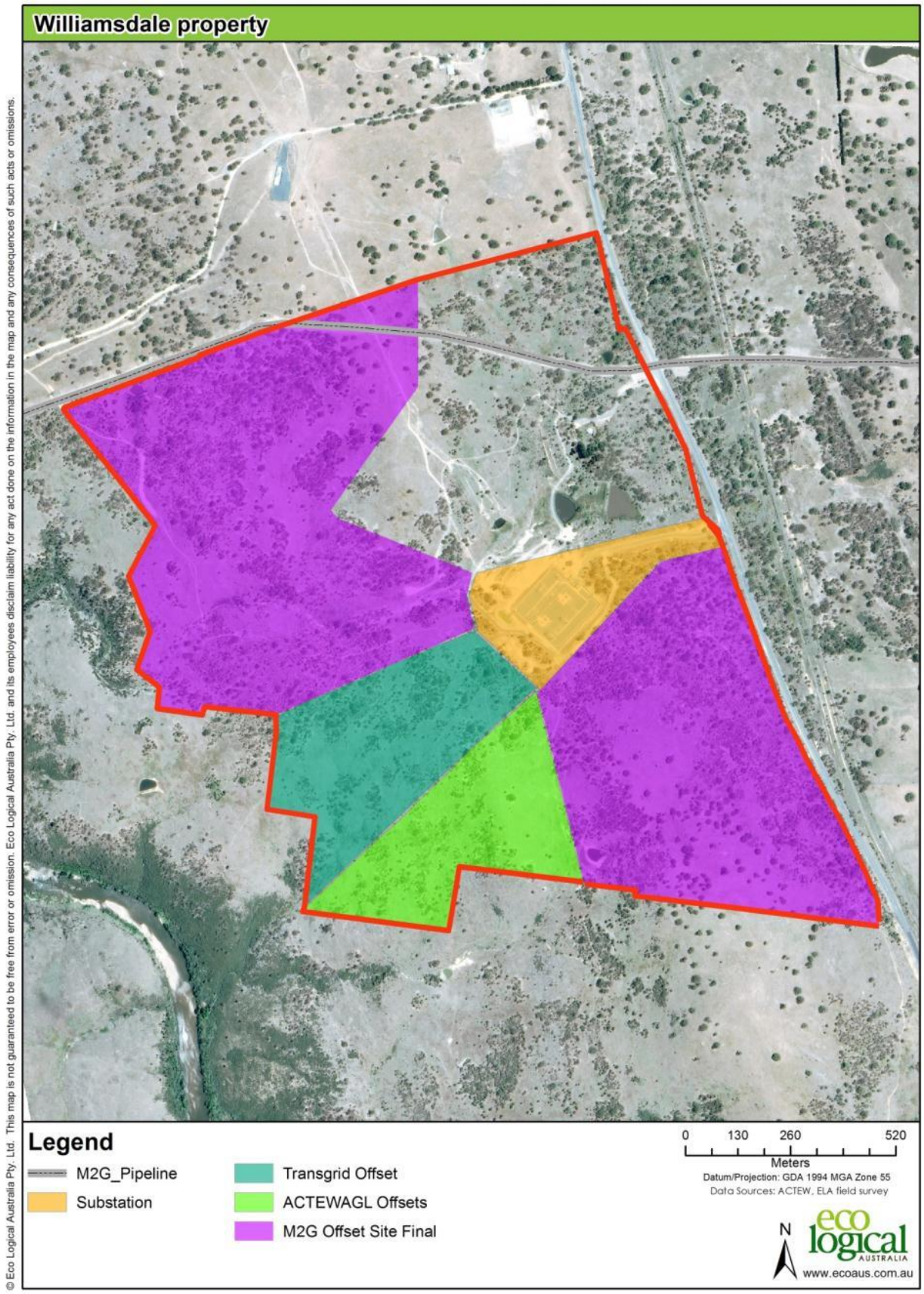


Figure 1: Study area

2 Methodology

The native vegetation and biodiversity values present within the offset site are managed under the ODP and its sub-plans. The ODP establishes the monitoring methodology for each of these values. A summary of the monitoring methodology outlined in the ODP is presented below, followed by the results of the spring 2015 monitoring surveys. The autumn 2015 monitoring surveys were undertaken during the period 20-24 April 2015.

2.1 Vegetation monitoring plot methodology

The monitoring methodology has been adapted from the NSW Biobanking methodology to suit the offset site management requirements. The modified Biobanking methodology proforma uses a combination of quadrat and transect surveys to establish vegetation condition, and this approach is mirrored under the monitoring methodology.

Vegetation surveys have been designed to collect the following data:

- Species diversity, including native and exotic species.
- Cover abundance of native and exotic species.
- Identification of any threatened flora.
- Condition of the vegetation community.

2.1.1 Floristic quadrats

Eight 20 m x 20 m monitoring quadrats (plots) were established to collect baseline data on the condition and species composition of the offset site during autumn and spring each year (**Figure 2**). The quadrats are permanently erected and marked using a star picket at each corner tagged with flagging tape. The location of each quadrat has been referenced using a GPS device (north-west corner) and their location plotted on a map (**Figure 2**).

Each quadrat was surveyed by walking back and forth along 10 parallel transects approximately 2 m apart. A cumulative list of flora species within each quadrat was recorded and assigned a cover abundance score using the Braun-Blanquet scale.

Two of the eight plots (control plots) were chosen in order to observe natural changes in species composition over time. Both plots were located in areas of good quality EPBC Act listed Box-Gum Woodland and were free from noxious weeds at the time of establishment. Where possible, management actions, such as erosion control, or rehabilitation will not occur within these monitoring plots over the duration of the monitoring period. However, it is noted that some actions such as feral animal control occurs on an offset site scale. Also, if noxious weeds are observed within the control plots during the biannual monitoring surveys, the weeds will be identified, recorded and then removed. The removal of noxious weeds from the control plots is required to maintain the overall conservation principles of the offset site.

The other six monitoring plots were located in units where management actions were planned or likely to occur as outlined in the management sub-plans, in order to observe the effect that the actions have on ecological values and species composition over the course the monitoring program.

The monitoring plots are shown in **Figure 5 - Figure 12**. The GPS co-ordinates of the north-west corner of each monitoring plot are provided below in **Table 1**. A species list for each of the monitoring plots is included in **Appendix A**.

Table 1: Monitoring plot co-ordinates (GDA 1994 MGA Zone 55).

Monitoring plot	Plot location	Established	North-west corner		Transect	
			Easting	Northing	Easting	Northing
1	MU1A	October 2011	693669.49	6059272.51	693674.98	6059300.56
2	MU2B	March 2012	693529.99	6059555.34	693541.22	6059504.10
3	MU3	October 2011	693872.06	6059467.44	693874.65	6059490.73
4	MU4	October 2011	692349.35	6060568.08	692365.82	6060517.43
5	MU5	October 2011	692559.98	6059906.52	692526.40	6059902.85
6*	MU6	March 2012	692576.25	6060344.05	692622.53	6060358.54
7	MU7	March 2012	692860.59	6060583.39	692874.01	6060542.87
8*	MU3	October 2011	693414.37	6059863.02	693445.95	6059828.31

* Refers to the control plot

2.1.2 Point transects

A 50 m transect (50 m length of tape) was established at each of the monitoring plots to compliment the floristic quadrat surveys and to determine the projective foliage cover of various structural components of the community. Each transect was referenced using a GPS device and three photos were taken from the start of the transect (left side, centre, and right side). The 50 m transect was surveyed as follows:

- At every 1 m along the 50 m tape, the understorey layer was assessed (50 survey points per transect). The presence of native grass, native shrubs (<1m high), native other or exotic species was recorded at each point. For each group the number of hits was then tallied and doubled, and presented as a percentage cover for the whole site.
- At every 5 m along the 50 m tape, the percentage projective foliage cover of native and exotic species in the mid and overstorey layer was recorded (10 survey points per transect). For each group the cover values were then summed and divided by 10, and presented as a percentage cover for the whole site.

2.2 Flora inventory methodology

A cumulative list of species has been maintained since the initial baseline surveys were conducted. Species included on the list included those recorded within the eight monitoring plots and those encountered whilst traversing the sites during the weed, fence line and erosion monitoring surveys. A species list for offset site is provided in **Appendix A**.

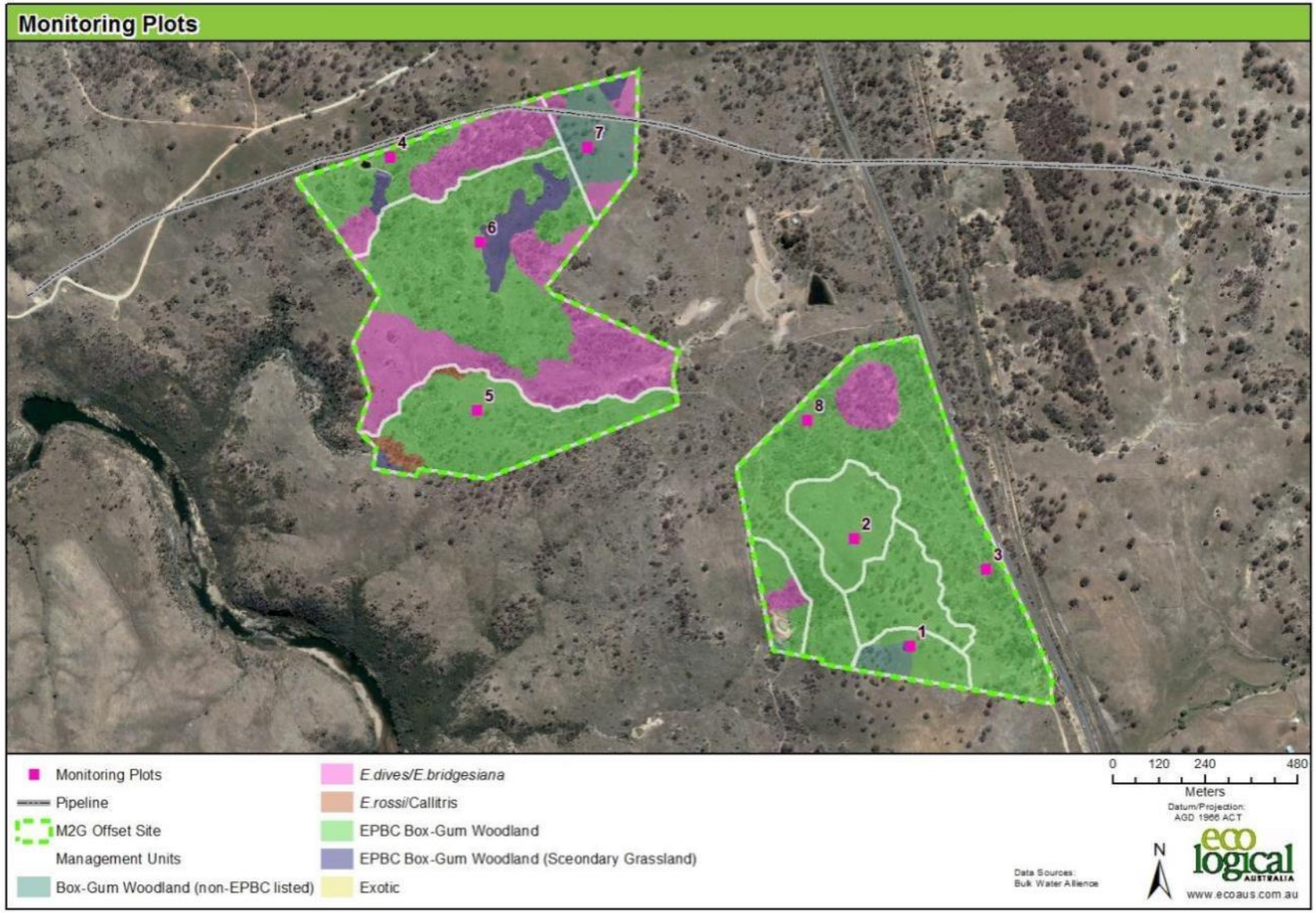


Figure 2: Monitoring plots, management units and baseline offset site ecological values

2.3 Swainsona recta monitoring

Monitoring of translocated *Swainsona recta* plants is conducted during the peak flowering period in October each year. The location of the three translocation plots is shown in **Figure 3**. Full details of the propagation and translocation program are provided in ELA (2013). Information relevant to the interpretation of monitoring results is summarized below.

Plants translocated were initially raised from seed sourced from Mt. Taylor, Williamsdale and Burra, and grown on in containers filled with either:

- Potting mix (standard nursery mix), or
- Soil mix containing a 1:1 ratio of potting mix and local soil from the seed collection sites.

A total of 112 individuals were planted across the three translocation plots, of which 66 were translocated in June 2012 and a further 46 translocated in September 2013. Each translocation plot was designed to accommodate up to 40 plants. Individuals were planted in blocks according to provenance and growing media to facilitate comparison. A key to the planting design and other relevant data is provided in **Table 2**.

Table 2: Planting key

Collection location	Growing media	Key	Planted	Water crystals
Mt Taylor	Potting mix		2012	No
Mt Taylor	Soil and potting mix		2012	No
Williamsdale	Potting mix		2013	Yes
Burra	Potting mix		2013	Yes

Individuals were planted at one metre spacing in a grid format (8 x 5 plants) with a one metre buffer from the outer most plants. Plots were established with the longest axis orientated in a north-south direction. Fencing was erected around the plots to incorporate a one metre buffer from the outer most plants. Fencing consisted of rabbit proof fencing (1.2 m high) with steel pickets at least every three metres.

At planting, all competition (e.g. grasses and other forbs) was removed in the immediate area of each individual (creating a cleared patched approximately 20 cm in diameter). For the 2013 plantings, a small handful or water crystals were also planted with each individual. All plants were watered on the day of planting and subsequently watered one week after planting

Each individual plant translocated is assessed annually for its survivorship and reproductive condition. The follow is recorded:

- presence or absence of *Swainsona recta* at each planting location
- presence or absence of flowers or developing seed pods

In addition, the translocation plots are inspected for signs of recruitment. The results allow a comparison of survivorship, condition and recruitment events at the end of each monitoring period and provide a picture of the overall success of the translocation program.

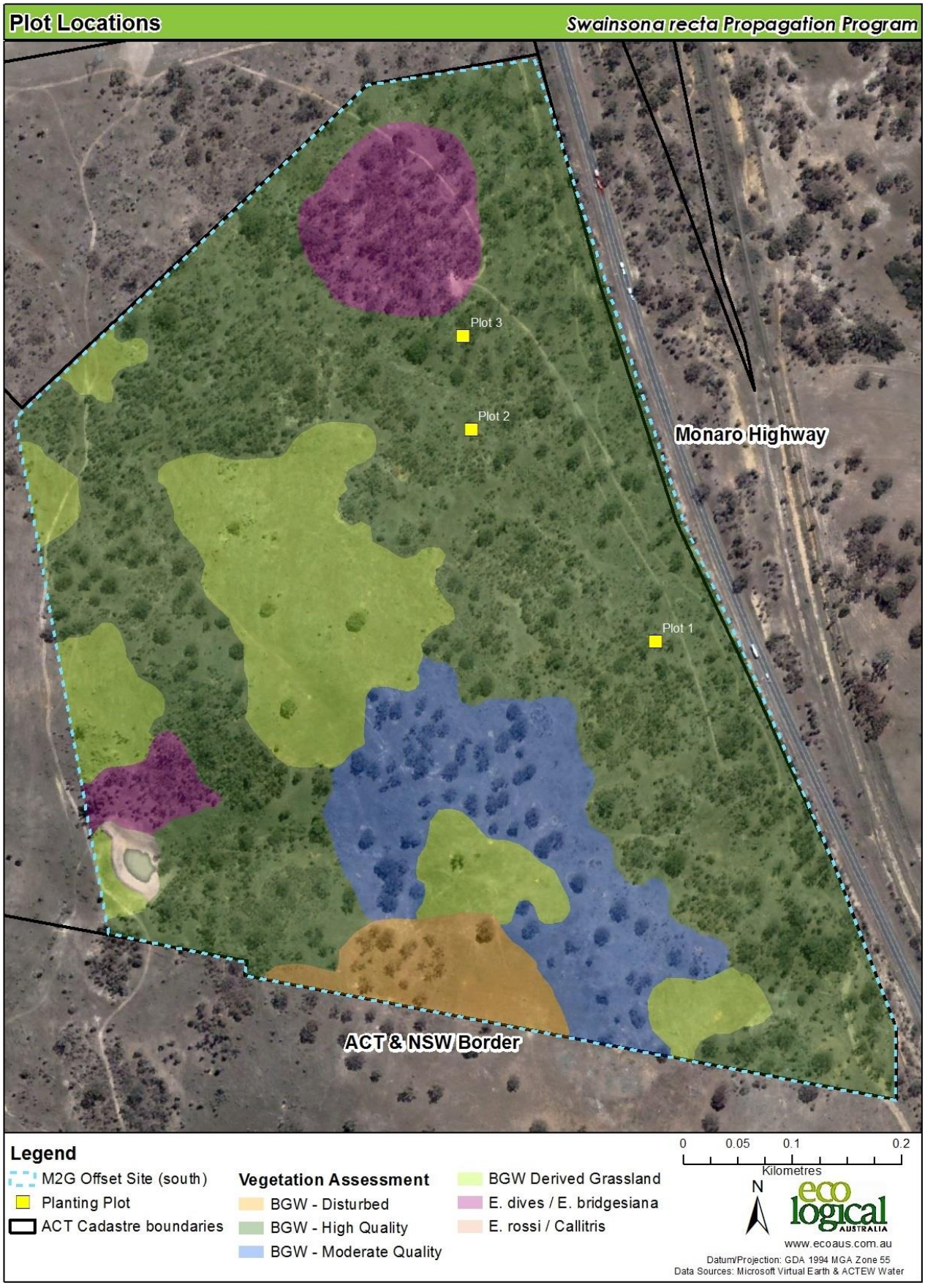


Figure 3 *Swainsona recta* translocation plots

2.3.1 Swainsona recta plot post-burn monitoring methodology

One of the recommendations made in the 2014 monitoring report was to undertake action to reduce the biomass present within the plots to ensure that *S. recta* plantings were not adversely affected. The Environmental Reference Group (ERG) meeting in December 2014 requested that any management undertaken within the plots be undertaken using an experimental approach. At the request of Icon Water, ELA developed an experimental design to reduce biomass within the plots using cool burns and native macropod grazing.

The design involved the application of a cool autumn burn to approximately 60% of the area of plots 1 and 3 (retaining approximately 40% of each plot unburnt) and allowing native herbivores to graze approximately 60% of the area of plot 2 (retaining approximately 40% of plot ungrazed). It was noted that there are limitations in the ability to draw statistically robust conclusions due to the relatively small number of plants and the inability to adequately replicate the treatments. An experimental approach is further complicated by the small size of plots, multiple provenances, planting configuration, uncertainty about whether absent plants are dead or alive and persisting as dormant rootstocks, and differing site attributes between plots (e.g. amount of shade).

To undertake the monitoring, six quadrats (1 x 1 m) were established within each translocation plot as per the proposed methodology (letter dated 5th march 2015). Quadrats were positioned so that they were centred over planted individuals of *Swainsona recta* (or planting location where plants were absent) at the following grid intersection points:

- A2, A4
- D2, D4
- G2, G4

The corners of each quadrat were permanently marked with metal pegs to allow for accurate relocation during subsequent monitoring events. Quadrats were photographed vertically to encompass the full quadrat area. A visual estimate of the cover/abundance of native and exotic species within each quadrat was recorded, and the health of any *S. recta* individuals present was noted as recommended in the *Swainsona* monitoring program. The percentage cover of vegetation (all vascular species), bare ground, cryptogams and litter was estimated within each quadrat. Photographs of each plot were also taken from the northern side looking southward.

As the plots are arranged in 5 rows, it was not possible to achieve an even split between treated and un-treated individuals.

2.4 Bird survey methodology

During spring 2015, a quantitative bird survey methodology was implemented to gather information on species abundance and species richness in a repeatable manner. Bird surveys were undertaken along two transects, one in each of the offset sites. Each transect comprised 5 points approximately 100 m apart. The transect was not selected to be straight but rather to follow areas of suitable habitat. At each point along the transect the abundance and species richness of bird species was surveyed in a circle with a 50 m radius over a 10 minute survey period (total of 50 minutes per transect which covers an area of 0.07ha). Birds were recorded in the following distance classes from the survey point:

- 0-15 m
- 15-30 m
- 30-50 m

Any other species recorded during the survey period either outside of 50 m, flying over the site or between points was recorded as opportunistic.

2.5 Weed monitoring methodology

The management of weeds within the M2G offset site is undertaken in accordance with the Weed Monitoring Sub-Plan. The sub-plan outlines the weed management activities to be undertaken in order to satisfy relevant approval conditions and commitments. As an action under the sub-plan, the monitoring of weeds within the offset is required on a biannual basis to incorporate the seasonal changes in weed abundance and weed control activities.

Weed monitoring in spring 2015 was undertaken opportunistically with an overall assessment of each management unit focussed on occurrences of declared species (*Cotoneaster* spp., *Crataegus monogyna*, *Eragrostis curvula*, *Hypericum perforatum*, *Nassella trichotoma*, *Pyracantha* spp., *Rosa rubiginosa*, *Rubus fruticosus* and various species of thistle), non-declared woody weeds and species not previously recorded for the site.

2.6 Erosion monitoring methodology

Erosion monitoring sites were established during the autumn 2012 monitoring surveys. During these baseline surveys a representative sample of erosion points within each of the main drainage lines were selected for future monitoring. For each erosion point selected, notes were made on their size, their location was recorded using a GPS and a photo was taken in order to observe any changes over time. A number of erosion monitoring points were discontinued from spring 2013 onwards, as these points did not shown signs of erosion since the baseline surveys, despite significant rain events occurring over this two year period.

When each monitoring survey is undertaken, a set of baseline photographs are taken into the field to facilitate accurate relocation of erosion monitoring photo points and assessment of change.

2.7 Fencing monitoring methodology

Fence monitoring was undertaken by traversing the Williamsdale property border and assessing the condition of the fence. Any damaged areas observed along the fence line were noted and a GPS point taken. Fence damage was categorised into three categories to represent the level of risk of unwanted grazers (such as cattle) entering the offset site:

- *Low risk*– Small holes observed at the bottom of the fence that does not require immediate attention and allows native fauna (e.g. wombats) to pass through.
- *Moderate risk* – Small to moderate sized holes or fence damage that requires monitoring, but no immediate action. Often observed along the fence line bordering the Murrumbidgee River corridor and represents a potential goat or sheep access point. Note; there can be a small difference between the low and moderate categories. However, other evidence such as tracks and scats that may represent feral presence was used to inform the level of risk.
- *High risk* – Represents points along the fence line requiring attention. These points represent a high risk of cattle and sheep entering the property.

2.7.1 Fauna habitat assessment

During the baseline survey a fauna habitat assessment was conducted within each 20 m x 50 m vegetation monitoring plot to observe the number of hollow bearing trees, length of fallen logs (greater than 10 cm width) and dominant habitat features present. In addition, a qualitative assessment of fauna habitat features was undertaken for each of the northern and southern offsets. This assessment

included features such as, hollow-bearing trees, logs, litter, fallen timber, stags, surface or outcropping rocks, termite mounds, mistletoe presence, large trees, natural regeneration and exotic or native shrub thickets. These features were checked during each monitoring period to ensure they remained applicable.

The fauna habitat assessments are outlined in **Table 6** and **Table 7**

2.7.2 Opportunistic observations

Visual and aural observations of all vertebrate fauna species (including signs of feral animal activity) were recorded opportunistically whilst conducting targeted monitoring surveys across the offset site and using random meander techniques (species list available in **Appendix B**). Locations of conservation significant fauna and signs of feral animal presence were referenced using a GPS device.

3 Biodiversity values

3.1 Ecosystem health

The offset site supports a diverse range of flora, fauna and habitats. Since the removal of stock from the site, there has been an increase in the recruitment of shrub species such as *Acacia dealbata* and *Acacia rubida*, as well as an increase in recruitment of canopy species. The site supports diverse functional ecosystems and is considered to be in good health and likely to be resistant to disturbance events due to its diversity.

While the offset site has been in good health to date, the autumn 2015 surveys observed that a large proportion of the *Eucalyptus blakelyi* (Blakely's Red Gum) within the offset site have been subject to leaf attack by Lerps (Psyllids). Severe infestations by lerps can be detrimental to trees resulting in leaf-drop, defoliation and subsequently die-back if the lerps are present over several seasons (Stone and Urquhart, 1995). Anecdotal evidence suggests that Lerp infestations occur broadly across the ACT region with infestations also noted at Central Molonglo, Kama Nature Reserve, and within road side trees in Belconnen and North Canberra. The infestation is not confined to the M2G property, nor is it the only area affected.

Outbreaks of lerps are known to be associated with the presence of *Manorina melanocephala* in some areas. However, bird surveys conducted within the offset site in spring 2015, indicate that the population of Noisy Miners within the offset site preferentially occurs in some areas over others such as the drainage line along the northern side of the north offset. The incidence of lerp is widespread across the site and surrounding areas and is unlikely to be linked to the presence or abundance of Noisy Miners. While Noisy Miners do not appear to be related strongly to the presence of lerps, it was noted that the abundance of other bird species within areas containing Noisy Miners was substantially reduced.

3.2 Flora

Approximately 217 native plant species (as well as 122 exotic species) have been recorded for the M2G offset site since the baseline surveys were undertaken (**Appendix A**). The list has continued to grow with each survey. The detection of new records for the site is influenced by factors such as time since cessation of grazing, seasonal conditions and the meander routes chosen by the ecologists undertaking the surveys.

The flora recorded includes a range of widely distributed characteristic woodland species, several rare and uncommon species in the ACT, and four threatened species listed under the EPBC Act (**Table 3**, **Table 4**, and **Figure 4**). The spring 2015 surveys recorded for the first time the presence of *Desmodium brachypodum* (Large Tick-trefoil) which is considered an uncommon species in the ACT.

Plates of some of the threatened, rare and uncommon species are included in **Appendix C**.

3.2.1 Threatened flora species

An annotated list of nationally threatened species occurring on the offset is provided in **Table 3** below.

Table 3: Threatened flora species within the offset site

Species	EPBC Act Status	NC Act Status	Notes
Leucochrysum albicans var. *tricolor* (Hoary Sunray)	Endangered	Not listed	Endangered herbaceous perennial. Noted as rare in the offset site in spring 2014. The species is abundant within adjacent land managed by Transgrid where it is growing profusely on batters surrounding the substation. It is unclear whether Hoary Sunray has seeded naturally onto the batters or whether it has been planted. It is considered likely that the individuals within the offset site have originated from the adjacent population.
Pomaderris pallida (Pale Pomaderris)	Vulnerable	Not listed	Vulnerable shrub to about 1.5 m high. Located in the central western part of the northern offset. A solitary flowering adult plant approximately 90 cm high was found in spring 2014, surrounded by approximately 10 juveniles and 2 sub-adults (flowering but only about 30-40 cm high). The species is known to occur within the Murrumbidgee River corridor, and it appears that the population within the offset site has established as an outlier.
Swainsona recta (Small Purple-pea)	Endangered	Endangered	Endangered herbaceous perennial. This species was found on the M2G offset site during initial surveys of the site in 2010 but has not been encountered since. Three translocation exclosure plots have been established on site.
Thesium australe (Austral Toadflax, Toadflax)	Vulnerable	Not listed	Austral Toadflax is a hairless, yellowish-green perennial herb with slender, wiry stems to 40 cm high. The species is semi-parasitic on roots of a range of grass species notably Kangaroo Grass. Approximately 4 individuals were recorded within the Northern offset in Themeda grassland adjacent to the main drainage line which traverses the site. The species is only known from a few records within the Canberra region.

3.2.2 Rare and uncommon ACT species

A number of species considered to be rare or uncommon within the ACT have also been recorded within the offset site to date. These species are outlined in **Table 4** below.

Table 4: Rare and uncommon species recorded within the offset site

Species	Notes
Austrostipa setacea (Corkscrew Grass)	Tufted perennial grass. Noted in the south-eastern corner of the southern offset in spring 2014. Dozens of plants recorded but extent of distribution on site not established.
Bossiaea prostrata (Creeping Bossiaea)	Prostrate perennial subshrub. Recorded in monitoring plot 5 in the northern offset and in the surrounding area. Relatively few localised patches known within offset.
Desmodium brachypodum (Large Tick-trefoil)	Large pea-flowered herb. Recorded in the south-eastern part of the southern offset. Only known occurrence within the offset site.
Discaria pubescens (Australian Anchor Plant)	Rigid shrub with prominent paired stem spines. A localised patch of approximately 26 plants occurs in the northern offset. This species was in full flower in October.
Glossostigma elatinoides	Prostrate perennial wetland forb. Localised patch noted in spring 2014 on the banks of the dam in the northern offset. This species was in full flower in October.
Limosella australis (Australian Mudwort)	Diminutive perennial wetland forb. Localised plants noted in spring 2014 on the banks of the dam in the northern offset.
Microseris lanceolata (Yam Daisy)	Perennial forb with fleshy tuberous roots. Recorded in monitoring plot 3 in the southern offset. Generally occurs in better condition vegetation within the offset.
Plantago gaudichaudii (Narrow Plantain)	Perennial forb with thick fleshy taproot. Recorded in monitoring plots 3 (southern offset) and 4 (northern offset). Generally occurs in better condition vegetation within the offset.
Stylidium despectum (Dwarf Triggerplant)	Erect diminutive annual forb occurring in moist situations. Localised plants noted in spring 2014 along moist drainage line in the northern part of the southern offset.
Swainsona monticola (Notched Swainson-pea)	Low spreading herbaceous perennial. Noted in the south-eastern corner of the southern offset in spring 2014. Dozens of plants seen but extent of distribution on site not established. Plants probably die back to a rootstock in summer and are difficult to detect unless flowering.
Swainsona sericea (Silky Swainson-pea)	Low spreading herbaceous perennial. Recorded in monitoring plots 3 (southern offset) and 5 (northern offset) in spring 2014. This species was abundant and widely distributed across both the north and southern offsets in spring 2014 and spring 2015. Plants are easily overlooked unless flowering.
Zornia dyctiocarpa	Low herbaceous perennial. Noted in the north eastern corner of the southern offset. Extent of distribution on site not established

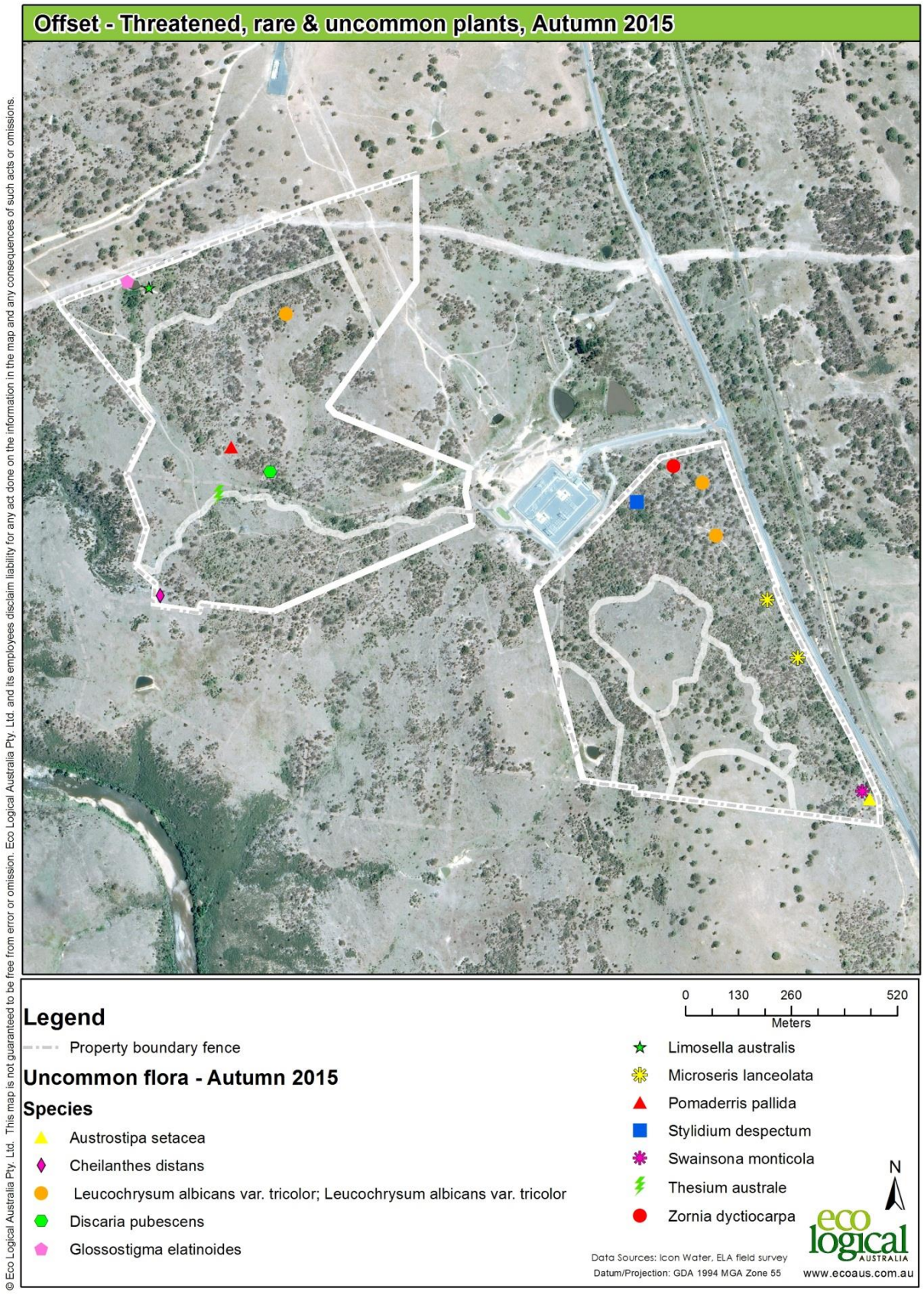


Figure 4: Opportunistic records of threatened, rare and uncommon flora species, autumn 2015

3.3 Fauna

A broad range of fauna species have been recorded within the offset site since the offset was established including 63 bird species, 12 mammal species, six reptiles, and six amphibians. A cumulative list of species recorded is provided in **Appendix D**.

3.3.1 Bird monitoring

Previous monitoring on the offset site has recorded a number of woodland bird species recognised as being in decline throughout their range including *Stagonopleura guttata* (Diamond Firetail), *Microeca fascinans* (Jacky Winter), *Aphelocephala leucopsis* (Southern White-face), *Chthonicola sagittatus* (Speckled Warbler), *Eopsaltria australis* (Eastern Yellow Robin) and *Lalage tricolor* (White-winged Triller). The spring 2015 monitoring also recorded *Melanodryas cucullata cucullata* (Hooded Robin) within the Williamsdale property, which was last recorded in the offset site during surveys in 2010.

Bird monitoring undertaken during spring 2015 recorded 35 species of which 14 were opportunistic records. The point monitoring recorded 90 individuals across 21 species. An abundance index was generated and is outlined in **Table 5** below.

The monitoring identified that the Noisy Miner and the *Gymnorhina tibicen* were the most frequently encountered species in the offset site, however, the Noisy Miner was recorded at higher abundances in each instance that the Australian Magpie. This result is highly skewed by large numbers of Noisy Miners present in some plots in the northern offset. Other commonly recorded species included the *Platycercus elegans* and *Eolophus roseicapilla*.

Table 5 Species abundance index (highest to lowest)

Common name	Latin name	No. records	No. of individuals	Abundance index
Noisy Miner	*Manorina melanocephala*	6	25	0.83
Australian Magpie	*Gymnorhina tibicen*	6	10	0.33
Rosella, Crimson	*Platycercus elegans*	5	10	0.33
Galah	*Eolophus roseicapillus*	4	5	0.17
Pied Currawong	*Strepera graculina*	3	5	0.17
Thornbill, Yellow-Rumped	*Acanthiza chrysorrhoa*	3	5	0.17
Red Wattlebird	*Anthochaera carunculata*	3	4	0.13
Magpie Lark	*Grallina cyanoleuca*	3	3	0.10
Noisy Friarbird	*Philemon corniculatus*	2	3	0.10
Pardalote, Striated	*Pardalotus striatus*	2	3	0.10
White-fronted Gerygone	*Gerygone olivacea*	3	3	0.10
Common Starling	*Sturnus vulgaris*	1	2	0.07
Honeyeater, Yellow Faced	*Lichenostomus chrysops*	2	2	0.07
Whistler, Rufous	*Pachycephala rufiventris*	2	2	0.07
Willie Wagtail	*Rhipidura leucophrys*	2	2	0.07
Black-faced Cuckoo-Shrike	*Coracina novaehollandiae*	1	1	0.03
Little Bronze Cuckoo	*Chrysococcyx minutillus*	1	1	0.03
Pallid Cuckoo	*Cuculus pallidus*	1	1	0.03
Robin, Eastern Yellow	*Eopsaltria australis*	1	1	0.03
Rosella, Eastern	*Platycercus adscitus*	1	1	0.03
Weebill	*Smicrornis brevirostris*	1	1	0.03

3.3.2 Fauna habitat assessment

A rapid assessment of the range of fauna habitat features present across the offset site and their abundance was undertaken during the baseline surveys in 2010. These values were subsequently confirmed during surveys in autumn 2015 and are presented below in **Table 6**. The following categories were used to identify abundance or frequency of each feature:

- *Abundan*t = feature occurs in an almost continuous manner.
- *Common* = feature encountered commonly, i.e. without having to search for it.
- *Occasional* = feature occurs in more than a few cases, but not encountered frequently.
- *Rare* = feature observed very infrequently, one to a few cases at most.

Table 6: Fauna habitat features observed across the offset site

Fauna habitat feature	Northern	Southern
Tree hollows	Occasional	Occasional
Large trees > 60 cm DBH	Occasional	Occasional
Dead standing trees	Occasional	Rare
Stumps (<2 m)	Rare	Rare
Mistletoes	Common	Common
Regenerating tree thickets	Abundant	Abundant
Native shrub thickets	Common	Occasional
Exotic shrub thickets	Occasional	Occasional
Logs (fallen)	Occasional	Occasional
Timber (fallen)	Occasional	Occasional
Litter (leaf, twig, bark)	Common	Common
Loose rocks	Common	Common
Outcropping rocks	Common	Common
Termite mounds	Rare	Rare
Meat ant nests	Occasional	Occasional
Earth banks/deep gully walls	Rare	Rare

An assessment of the dominant habitat features recorded within each 50 m x 20 m vegetation monitoring plot was also undertaken during the baseline surveys. These features were reassessed in autumn 2015. No significant change was observed relative to the baseline condition (**Table 6**). These values were not re-assessed in spring 2015 as these values are slow to change but will increase naturally over time.

Table 7: Habitat assessment within 50 m x 20 m vegetation monitoring plots

Plot	HBT	Logs	Comment	Dominant habitat features present within 50 m x 20 m plot Autumn 2015
1	0	0 m	No	Limited surface rocks; abundant exotic annuals
2	0	1 m	No	Surface and outcropping rocks abundant; course woody debris
3	0	11 m	No	Litter common; logs occasional; single ant's nest present
4	0	22 m	No	Developing canopy regeneration; occasional course woody debris
5	0	3 m	No	Developing canopy regeneration; ants nest; course woody debris; limited
6	0	0 m	No	Course woody debris common; developing canopy regeneration
7	0	8 m	No	Surface rocks and course woody debris uncommon; abundant exotic
8	0	14 m	No	Litter; course woody debris; bare ground; hollow logs; surface rocks

4 Vegetation monitoring

Since the baseline monitoring was undertaken in 2010, species diversity has generally remained stable or increased across the majority of monitoring plots. The spring 2015 monitoring data shows a slight increase in species diversity and cover of native grasses from the 2014 monitoring period. Seasonal variation between the monitoring years significantly changes how readily detectable flora species are and is a major consideration when analysing trends in floristic data, particularly over a relatively short period.

The stability/increase in diversity across the survey periods suggests that current management practices are improving site condition. While the number of native species recorded across the site has increased over time since the baseline monitoring, the proportion of exotic species has also increased over this time period. This increase may be attributed to a range of factors including the reduction in grazing pressure and corresponding increase in seeding events, which may have facilitated the spread of a range of introduced species already present on the greater site but at lower levels of abundance.

All monitoring plots remain below the overstorey cover and the total length of fallen logs benchmark values established for the ACT (Sharp & Milner 2014). Saplings of overstorey species are present at most sites and in time will contribute to an increase in overstorey cover. The abundance of saplings across the site is expected to decline over time as they compete for resources and the dominant saplings outcompete the remainder.

The results of the vegetation monitoring are provided in the following pages. The raw floristic data for each plot are provided in **Appendix A**.

4.1.1 Monitoring plot 1

Plot Description				
Management unit	MU1A		*Plot number*	1
Vegetation type	Box-Gum Woodland		*Condition*	Low-mod
Plot Statistics (%)	***Baseline***	**Spr. 2015**	**Overstorey**	
Native overstorey cover	*0*	0	Regeneration	Poor
Native midstorey cover	*0*	0	Species	*E. blakelyi*
Native understorey cover (grass)	*40*	16	**Habitat features**	
Native understorey cover (other)	*6*	8	Tree hollows	0
Exotic midstorey plant cover	*0*	0	Fallen logs	0 m
Exotic understorey plant cover	*58*	80		
Other (litter, bare, rock)	*N/R*	12		
Native species diversity	*14*	19		

Monitoring plot 1 is located within MU1A on the southern offset. The plot is composed of lower condition Box-Gum Woodland. A few eucalypt saplings were observed in the vicinity of the plot but none were recorded in the plot or along the transect. Native species diversity was low-moderate (19 species), marginally more than recorded in the spring 2012 surveys. Seventeen introduced species were recorded, with the number of species and cover being substantially higher than recorded during the baseline survey. *Carthamus lanatus, Bromus hordeaceus* and *Trifolium subterraneum* dominate the plot. More frequent native species included *Austrostipa scabra, Bothriochloa macra* and *Carex inversa*. Fauna habitat features within MU1A have not changed noticeably since the baseline surveys. Native plant species richness, overstorey cover and the total length of fallen logs are well below benchmark values (Sharp & Milner 2014).

Figure 5: Monitoring Plot 1. (Left: Baseline monitoring photo, October 2011. Right: Monitoring photo October 2015)

4.1.2 Monitoring plot 2

Plot Description				
Management unit	MU2B		*Plot number*	2
Vegetation type	Box-Gum Woodland		*Condition*	Mod-Good
Plot Statistics (%)	***Baseline***	**Spr. 2015**	**Overstorey**	
Native overstorey cover	*0*	2	Regeneration	Yes
Native midstorey cover	*0*	0	Species	*E. blakelyi*
Native understorey cover (grass)	*80*	52	**Habitat features**	
Native understorey cover (other)	*4*	14	Tree hollows	0
Exotic midstorey plant cover	*0*	0	Fallen logs	1 m
Exotic understorey plant cover	*6*	72		
Other (litter, bare, rock)	*7*	14		
Native species diversity	*30*	41		

Monitoring plot 2 is located within MU2B within the southern offset. It is situated on a rocky hill containing Pink-tailed Worm Lizard habitat. Outcropping and surface rocks constitutes over 10% of the ground cover. It contains good condition mature Box-Gum Woodland with scattered eucalypt saplings present. A total of 41 native species were recorded within the plot, which is consistent with previous surveys. Frequent native species include *Chrysocephalum apiculatum, Austrostipa* spp. and *Bothriochloa macra*. Twenty-two introduced species were recorded, which is five more than recorded in spring 2012. Fauna habitat features within MU2B have not changed noticeably since the baseline surveys. Native plant species richness is above benchmark values (Sharp & Milner 2014), however overstorey cover and the total length of fallen logs remain well below benchmark.

Figure 6: Monitoring Plot 2. (Left: Baseline monitoring photo, March 2012. Right: Monitoring photo October 2015)

4.1.3 Monitoring plot 3

Plot Description				
Management unit	MU3		*Plot number*	3
Vegetation type	Box-Gum Woodland		*Condition*	Mod-Good
Plot Statistics (%)	***Baseline***	**Spr. 2015**	**Overstorey**	
Native overstorey cover	*3.7*	6	Regeneration	Yes
Native midstorey cover	*5.2*	5	Species	*E. blakelyi*
Native understorey cover (grass)	*80*	58	**Habitat features**	
Native understorey cover (other)	*16*	28	Tree hollows	0
Exotic midstorey plant cover	*0.2*	0	Fallen logs	11 m
Exotic understorey plant cover	*10*	60		
Other (litter, bare, rock)	*N/R*	4		
Native species diversity	*27*	38		

Monitoring plot 3 is located within MU3 in the southern offset. The plot is located in moderate to good quality Box-Gum Woodland. A significant number of eucalypt saplings are present. A total of 38 native species were recorded within the plot, eight (8) more than during the autumn 2013 surveys. The understorey is dominated by *Themeda triandra*, with co-occurring native species having significantly lower cover values. The native mid-storey species *Bursaria spinosa* was present but rare. Twenty-four introduced species were recorded, which is comparable with spring 2012. Frequent weeds include *Aira* spp. and *Hypochaeris glabra*. Fauna habitat features within MU3 have not changed noticeably since the baseline surveys. Native plant species richness is above benchmark values (Sharp & Milner 2014), however overstorey cover and the total length of fallen logs remain well below benchmark.

Figure 7: Monitoring Plot 3. (Left: Baseline monitoring photo, October 2011. Right: Monitoring photo October 2015)

4.1.4 Monitoring plot 4

Plot Description				
Management unit	MU4		*Plot number*	4
Vegetation type	Box-Gum Woodland		*Condition*	Mod-Good
Plot Statistics (%)	***Baseline***	**Spr. 2015**	**Overstorey**	
Native overstorey cover	*4.7*	9	Regeneration	Yes
Native midstorey cover	*11.5*	8	Species	*E. blakelyi*
Native understorey cover (grass)	*74*	78	**Habitat features**	
Native understorey cover (other)	*18*	50	Tree hollows	0
Exotic midstorey plant cover	*2*	0	Fallen logs	22 m
Exotic understorey plant cover	*28*	46		
Other (litter, bare, rock)	*N/R*	4		
Native species diversity	*24*	34		

Monitoring plot 4 is located in the northern offset in MU4. It is located in moderate to good quality Box-Gum Woodland dominated by *E. blakelyi*. A total of 34 native species were recorded within the plot. The understorey is dominated by *Themeda triandra*, *Microlaena stipoides, Asperula conferta* and *Haloragis heterophylla*. Twenty-one introduced species were recorded which is comparable to previous monitoring periods. Frequent weeds include *Bromus hordeaceus* and *Hypochaeris radicata*. Control of *R. rubiginosa* has been effective with cover of this species much reduced compared to earlier years. Fauna habitat features within MU4 have not changed noticeably since the baseline surveys. Most site parameters are just below, within or above benchmark values (Sharp & Milner 2014), except for total length of fallen logs.

Figure 8: Monitoring Plot 4. (Left: Baseline monitoring photo, October 2011. Right: Monitoring photo October 2015)

4.1.5 Monitoring plot 5

Plot Description				
Management unit	MU5		*Plot number*	5
Vegetation type	Box-Gum Woodland		*Condition*	Mod-Good
Plot Statistics (%)	***Baseline***	**Spr. 2015**	**Overstorey**	
Native overstorey cover	*0*	0	Regeneration	Yes
Native midstorey cover	*11*	0	Species	*E. blakelyi*
Native understorey cover (grass)	*76*	52	**Habitat features**	
Native understorey cover (other)	*14*	16	Tree hollows	0
Exotic midstorey plant cover	*0*	0	Fallen logs	3 m
Exotic understorey plant cover	*4*	60		
Other (litter, bare, rock)	*16*	6		
Native species diversity	*29*	46		

Monitoring plot 5 is a control plot located in MU5. No management actions will occur within the boundaries of the plot. Plot 5 is located in moderate-good quality Box-Gum Woodland dominated by *E. blakelyi* with a significant amount of natural regeneration present. It is noted that the regeneration is thinning in some areas. The plot supports a highly diverse understorey of graminoids and forbs with 46 native species recorded in spring 2015, although this is 14 less than spring 2012. The understorey is dominated by *Themeda triandra* and *Chrysocephalum apiculatum*. Fifteen introduced species were recorded, which is comparable to previous surveys; no weed species currently has a cover value exceeding 5%. Fauna habitat features within MU5 have not changed noticeably since the baseline surveys. Native plant species richness is above benchmark values (Sharp & Milner 2014), however overstorey cover and the total length of fallen logs remain well below benchmark.

Figure 9: Monitoring Plot 5. (Left: Baseline monitoring photo, October 2011. Right: Monitoring photo October 2015)

4.1.6 Monitoring plot 6

Plot Description				
Management unit *Vegetation type*	MU6 Box-Gum Woodland		*Plot number* *Condition*	6 Mod-Good
Plot Statistics (%)	***Baseline***	**Spr. 2015**	**Overstorey**	
Native overstorey cover	*5.3*	5	Regeneration	yes
Native midstorey cover	*0*	0	Species	*E. blakelyi*
Native understorey cover (grass)	*80*	74	**Habitat features**	
Native understorey cover (other)	*10*	16	Tree hollows	0
Exotic midstorey plant cover	*0*	0	Fallen logs	0 m
Exotic understorey plant cover	*8*	68		
Other (litter, bare, rock)	*N/R*	6		
Native species diversity	*28*	39		

Monitoring plot 6 is located in MU6, along the central ridge line of the property, in moderate-good quality Box-Gum Woodland dominated by *E. blakelyi.* The plot is situated in an intersection between the woodland and derived grassland forms of the ecological community. Various sized *E. blakelyi* saplings are present within the plot. The plot supports a diverse understorey of grasses and forbs with no species dominant. Thirty-nine native species were recorded in spring 2015, compared with 45 species in the spring 2012. Twenty-four introduced species were recorded, an increase of six species since spring 2012. Frequent weeds include *Trifolium arvense, Tolpis umbellata* and *Vulpia* spp. Fauna habitat features within MU6 have not changed noticeably since the baseline surveys. Native plant species richness is above benchmark values (Sharp & Milner 2014), however overstorey cover and the total length of fallen logs remain well below.

Figure 10: Monitoring Plot 6. (Left: Baseline monitoring photo, March 2012. Right: Monitoring photo October 2015)

4.1.7 Monitoring plot 7

Plot Description				
Management unit	MU7		*Plot number*	7
Vegetation type	Box-Gum Woodland		*Condition*	low
Plot Statistics (%)	***Baseline***	**Spr. 2015**	**Overstorey**	
Native overstorey cover	*0*	0	Regeneration	No
Native midstorey cover	*0*	0	Species	*N/A*
Native understorey cover (grass)	*74*	4	**Habitat features**	
Native understorey cover (other)	*0*	22	Tree hollows	0
Exotic midstorey plant cover	*0*	0	Fallen logs	8 m
Exotic understorey plant cover	*34*	100		
Other (litter, bare, rock)	*N/R*	0		
Native species diversity	*13*	12		

Monitoring plot 7 is located within MU7 in the northern offset. The management unit is composed of degraded Box-Gum Woodland with the overstorey dominated by *E. blakelyi.* No recruitment of *E. blakelyi* was observed. Native species diversity in the plot was low (12 species) and comparable with the baseline survey. Only *Carex inversa* was common, though with less than 5% cover. Introduced species dominate the site, with 29 species recorded. Dominant weeds in spring 2015 were *Bromus hordeaceus* and *Trifolium subterraneum*. Fauna habitat features within MU7 have not changed noticeably since the baseline surveys. All site parameters were well below benchmark values (Sharp & Milner 2014), except for native understorey (other) cover.

Figure 11: Monitoring Plot 7. (Left: Baseline monitoring photo, March 2012. Right: Monitoring photo October 2015)

4.1.8 Monitoring Plot 8

Plot Description				
Management unit	MU3		*Plot number*	8
Vegetation type	Box-Gum Woodland		*Condition*	Mod-Good
Plot Statistics (%)	***Baseline***	**Spr. 2015**	**Overstorey**	
Native overstorey cover	*0*	1	Regeneration	Yes
Native midstorey cover	*8.5*	0#	Species	*E. blakelyi*
Native understorey cover (grass)	*80*	72	**Habitat features**	
Native understorey cover (other)	*14*	28	Tree hollows	0
Exotic midstorey plant cover	*0*	0	Fallen logs	14 m
Exotic understorey plant cover	*4*	34		
Other (litter, bare, rock)	*N/R*	14		
Native species diversity	*26*	34		

Monitoring plot 8 is a control plot located in MU3. No management actions are proposed to occur within the bounds of the plot. The plot is located in good quality Box-Gum Woodland dominated by *E. blakelyi.* Various sized *E. blakelyi* saplings are present within the plot. The understorey species is dominated by *Themeda triandra* with a diverse range of co-occurring graminoids and forbs. Thirty-four native species were recorded in spring 2015, a reduction of 7 species since the spring 2012 surveys. Twenty-nine introduced species were recorded, only one more than the number recorded in spring 2012. Fauna habitat features have not changed noticeably since the baseline surveys. Native plant species richness is above benchmark values (Sharp & Milner 2014), however overstorey cover and the total length of fallen logs remain well below benchmark.

it is noted that the transect was located incorrectly in spring 2015 which would account for the low mid story cover values.

Figure 12: Monitoring Plot 8. (Left: Baseline monitoring photo, October 2011. Right: Monitoring photo October 2015)

5 *Swainsona recta* monitoring

5.1 Results summary

The spring 2015 *Swainsona recta* census was undertaken on 20 October 2015. Of the 112 individuals planted within the three translocation plots, 33 were present in spring 2015. This represents an overall survivorship of 29%, which is down significantly from the 79% overall survivorship recorded in spring 2013. This result is however comparable with the number of individuals recorded in spring 2014 (32 individuals). While the total number of plants recorded is similar between 2014 and 2015, the proportion of plants within each plot is not the same with Plot 1 recording 4 more plants than 2014 and Plot 2 recording 4 less. Plot 3 recorded 1 more individual than 2014. Of those plants which were present, 51% were in flower or had immature fruits.

The Mt Taylor provenance plantings show approximately 19% of plantings still present in 2015 compared with approximately 45% of plantings sourced from the Burra and Williamsdale populations. This result is consistent with previous monitoring periods which have also demonstrated that those individuals from Burra and Williamsdale have better survived translocation to the site.

The 2015 surveys have illustrated that survivorship is difficult to quantify in planted *S. recta* individuals due to the species ability to persist without above ground growth. The 2015 surveys recorded one individual in plot 1 which was not present in either the 2013 or 2014 surveys, which means that 2015 is the first time that it has been recorded since it was planted at the site. Similarly, the 2014 survey recorded a number of individuals which were not present in 2015 but were present in earlier years. Given the ability of the species to persist using resources stored in its rootstock, it cannot be concluded based on this years' survey alone that these individuals are no longer present.

5.2 Post-burn monitoring results

The 2014 report identified that increasing biomass from perennial native grasses such as *Themeda triandra* could have a negative impact on the species ability to persist at the site due to competition for resources. The importance of inter-tussock spaces within natural temperate grassland communities is well understood in the literature. As such, a methodology was developed by ELA to assess whether introducing some disturbance to the plots such as grazing or fire would have a beneficial impact on the plantings.

In accordance with the methodology developed, half of each of two plots (plots 1 and 3) were treated with fire and half of plot 2 was opened to grazing (Refer to Section 2.3). Prior to implementing the treatments, ELA undertook a pre-treatment baseline survey (May 2015) to enable comparison of data before and after treatment.

Unfortunately, following the application of fire, the fences were not replaced around plots 1 and 3 which has meant that both plots have also had some disturbance from native herbivore species which was not intended in the original methodology. Evidence of grazing of some of the plantings was present in 2015, however, over 50% of plantings still showed evidence of flowering and fruiting. A summary of the data collected for each plot is presented in **Table 8** below, and a description, photos of each plot and raw data is provided in **Appendix B** of this report.

Table 8: Summary of floristic and cover attributes for *Swainsona recta* translocation plots

Measurement	Plot 1	Plot 2	Plot 3
Total vegetation cover	range 50-90% (n = 6), mean 59%	range 55-90% (n = 6), mean 75%	range 35-95% (n = 6), mean 70%
Total litter cover	range 20-80 (n = 6), mean 32%	range 5-25 (n = 6), mean 12.3%	range 5-27 (n = 6), mean 13.5%
Cryptogam cover	range 2-5 (n = 6), mean 2.8%	range 0-15 (n = 6), mean 4.3%	range 0-7 (n = 6), mean 2.2%
Bare ground	range 2-30 (n = 6), mean 18.3%	range 5-20 (n = 6), mean 8.3%	range 0-20 (n = 6), mean 9.3%
Total number of native vascular plant species	52	49	49
Total number of introduced vascular plant species	17	17	10

5.2.1 Effects of treatment on *Swainsona recta*

Across the three plots, there was an increase in species diversity between the pre-burn monitoring (May 2015) and the post-burn monitoring (October 2015). This is consistent with broader trends in species diversity which are seen across the offset site on a seasonal basis. The post-burn surveys recorded a decrease in total vegetation cover in those areas where the treatment was applied and an increase in total vegetation cover across those areas where no treatment was applied. Across all areas of the plot the amount of cryptograms evident reduced between May and October with a subsequent increase in the proportion of bare ground observed.

The post-burn surveys identified 23 of the 33 individuals recorded during the monitoring within the treated portions of the plots. This represents 70% of all individuals recorded during the 2015 survey period.

The 2015 surveys show some evidence that fire has had a beneficial impact on the number of individuals present. Plots 1 and 3 both showed an increase in the number of individuals present within the treated section (50% increase and 60% increase respectively) compared with the spring 2014 monitoring results. Similarly, the untreated sections registered a 30% decrease in the proportion of individuals present in both plots 1 and 2 but no change within plot 3. However, Plot 2 recorded a 50% reduction in the number of individuals present in the area which was grazed only, indicating that fire may have been the factor influencing the change in the presence of the species.

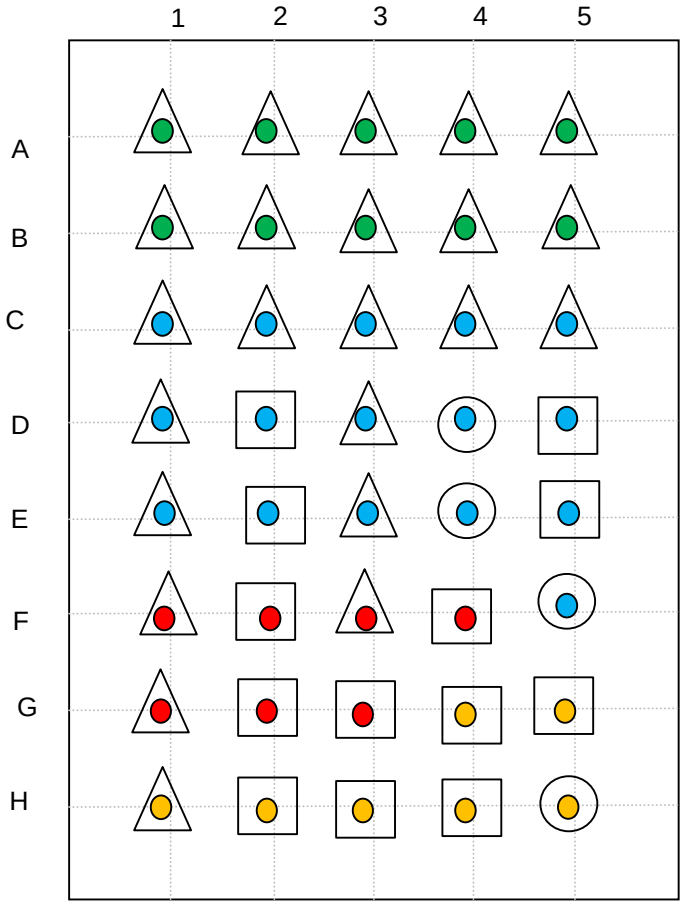
No recruitment was recorded within either treated or untreated plots.

It is noted that due to the restrictions around the design of the study including low number of replicates, unequal number of plantings and provenances it is not possible to statistically analyse the significance of these results. However, the results do show a strong positive correlation between the implementation of fire and the presence of planted *S. recta* individuals. Further monitoring will be undertaken in 2016.

5.2.2 Plot 1

Table 9: Plot 1 monitoring results

Key	Results	Comments
○	**Present** - in flower or immature fruit	5 plants fertile, from 2013 plantings
□	**Present** – lacking flowers and fruits	8 observed with leaf only, 2013 plantings
△	**Absent** - not observed	21 from 2012 & 6 from 2013 plantings not observed



Plot 1 - 2015

Plot 1 occurs within Box-Gum Woodland with a *Themeda triandra* dominated groundcover. A high diversity of native species and a low abundance of exotic species have been recorded within the surrounding area. The plot contains some open ground and inter-tussock spacing between *Themeda* tussocks and is on a slight east facing slope. *Eucalyptus blakelyi* surrounds the plot as the dominant overstorey with natural regeneration present. Shading from the overstorey is relatively low.

Forty individuals were planted within plot 1, of which 26 were from Mt. Taylor (10 potting mix & 16 soil plus potting mix) and 7 each were from the Williamsdale and Burra populations.

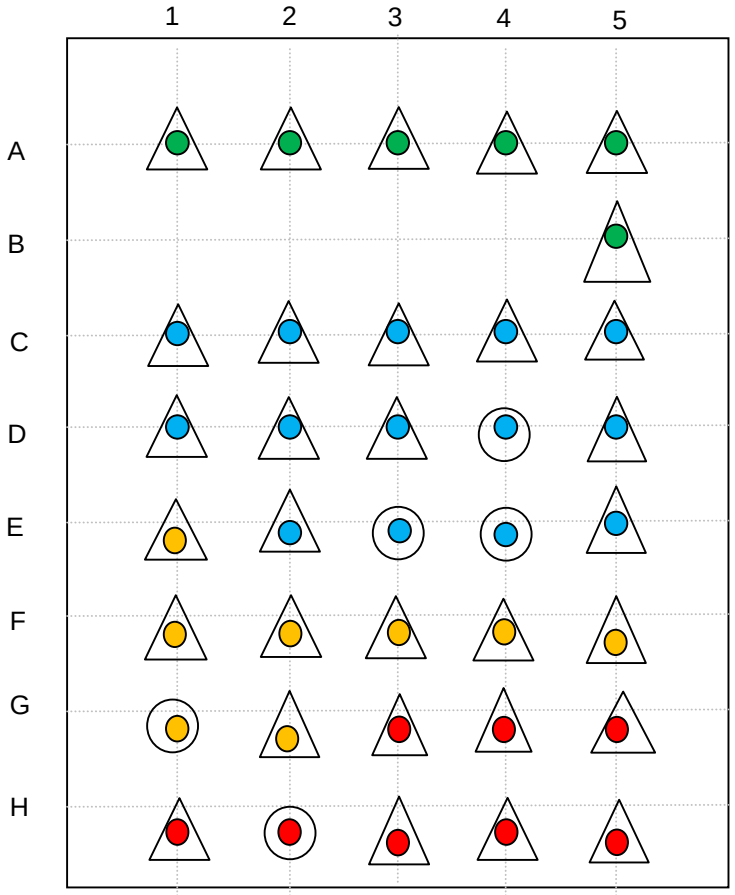
Of the 40 plants, 17 were present in spring 2015 (7 from 2012 plantings and 10 from 2013 plantings). No recruitment was observed within the plot.

Collection location	Growing media	Key	Planted	Water crystals
Mt Taylor	Potting mix		2012	No
Mt Taylor	Soil and potting mix		2012	No
Williamsdale	Potting mix		2013	Yes
Burra	Potting mix		2013	Yes

5.2.3 Plot 2

Table 10: Plot 2 monitoring results

Key	Results	Comments
◯	**Present** - in flower or immature fruit	8 plants fertile, mostly 2013 plantings
□	**Present** - lacking flowers and fruits	1 observed with leaf only
△	**Absent** - not observed	17 from 2012 & 10 from 2013 plantings not observed



Plot 2 - 2015

Plot 2 occurs within *E. blakelyi* dominated Box-Gum Woodland with the understorey dominated by *Austrostipa* spp. (Speargrass). A high diversity of native species and a low abundance of exotic species have been recorded within the surrounding area. The plot is established on a slight north-east facing slope. Natural regeneration is present in the general area, but no shading of the overstorey trees is likely to occur. Some rocky habitat occurs adjacent to the plot, but not within the plot.

Thirty-six individuals have been planted within plot 2, of which 20 were from Mt. Taylor (6 potting mix & 14 soil plus potting mix) and 8 each were from the Williamsdale and Burra populations.

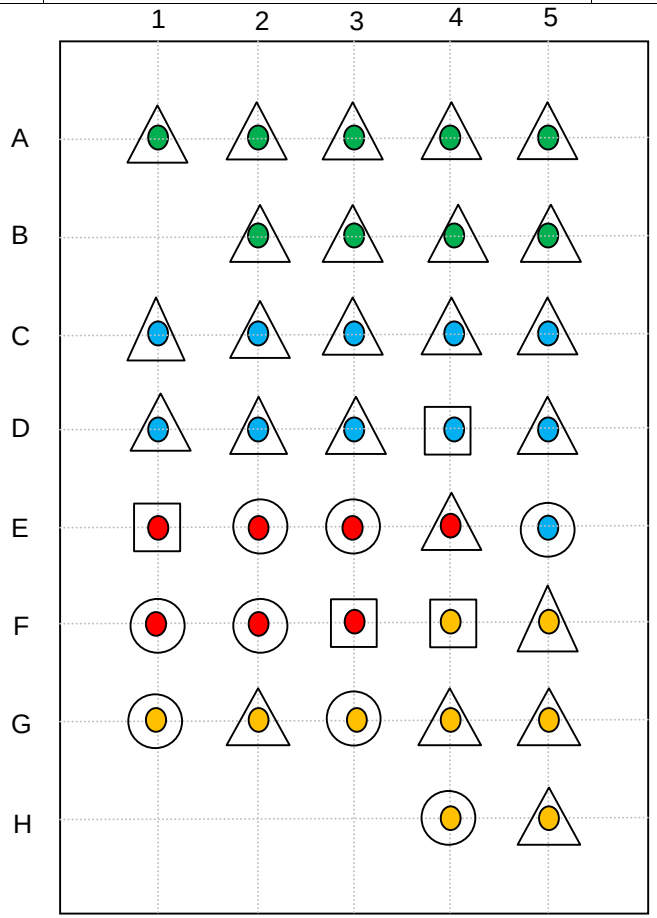
Of the 36 individuals, 5 were present in spring 2015 (3 from 2012 plantings and 2 from 2013 plantings). No recruitment was observed within the plot.

Collection location	Growing media	Key	Planted	Water crystals
Mt Taylor	Potting mix	●	2012	No
Mt Taylor	Soil and potting mix	●	2012	No
Williamsdale	Potting mix	●	2013	Yes
Burra	Potting mix	●	2013	Yes

5.2.4 Plot 3

Table 11: Plot 3 monitoring results

Key	Results	Comments
○	**Present** - in flower or immature fruit	8 plants fertile, mostly 2013 plantings
□	**Present** - lacking flowers and fruits	2 sterile plants, 2013 & 2013 plantings
△	**Absent** - not observed	18 from 2012 & 8 from 2013 plantings not observed



Plot 3 - 2015

Plot 3 occurs in *Eucalyptus bridgesiana* (Apple-box) / *E. dives* (Peppermint) woodland with an understorey dominated by *Themeda triandra*. A high diversity of native species and a low abundance of exotic species have been recorded within the surrounding area. The plot is established on a flat area on top of a small knoll. Limited surface rocks were observed within and immediately adjacent to the plot. Plot 3 is likely to experience moderate shading throughout the day from surrounding overstorey.

Thirty-six individuals have been planted within plot 2, of which 20 were from Mt. Taylor (9 potting mix & 11 soil plus potting mix), 7 were from the Williamsdale population and 9 from the Burra population.

Of the 36 individuals, 11 were present in spring 2015 (2 from 2012 plantings and 9 from 2013 plantings). No recruitment was observed within the plot.

Collection location	Growing media	Key	Planted	Water crystals
Mt Taylor	Potting mix		2012	No
Mt Taylor	Soil and potting mix		2012	No
Williamsdale	Potting mix		2013	Yes
Burra	Potting mix		2013	Yes

6 Weed monitoring

6.1 Weed management actions undertaken to date

Weed management on site has included control of the perennial grasses *Eragrostis curvula* (African Lovegrass) and *Nassella trichotoma* (Serrated Tussock) in mid-2012 and mid to late-2013, and control of the perennial broad-leaved species *Rosa rubiginosa* (Sweet Briar), *Rubus* sp. (Blackberry), and *Hypericum perforatum* (St. John's Wort) over the summer 2012 / 2013 and summer 2013 / 2014 periods. Follow up control was also undertaken in December 2014.

Weed spraying operations targeting Sweet Briar were being undertaken during the spring 2015 surveys. No other weed control was undertaken during 2015.

6.2 Priority areas for weed control works

A summary of weed occurrences across the offset site and comparison with baseline comments is provided in **Table 12**. **Table 8** also outlines which species are considered to be priority species for control works in 2016/17.

Priority areas for weed control works have also been identified across the offset site using the management unit boundaries to delineate areas. The priority areas for works have been assessed for six different species or groups of species as shown in **Figure 13 and Figure 14**. These figures show the priority areas for each species, however, the overall control priority for that species is represented in **Table 8**.

Table 12: Summary of prior weed occurrence and autumn 2015 monitoring results

Species	Weed occurrence prior to current surveys (baseline)	Current status
African Lovegrass (*Eragrostis curvula*)	Low, localised areas of dominance. Present across the offset site in isolated patches. Where it occurs, it forms a dense mat of tussocks and dominates the understory.	Relatively few isolated individuals or small patches were observed along tracks across the offset site with some heavier infestations around the main drainage line around MU5/6. Control of the infestation within the main drainage channel should be undertaken to minimise spread of propagules through downstream areas. **MU occurrence**: MU2A, 6, 7 **Recommendation**: Follow-up weed control required targeting drainage lines and isolated individuals. **Priority**: High
Serrated Tussock (*Nassella trichotoma*)	Low, scattered individuals in some areas. Present in open areas of the offset site. Primarily present as a number of scattered individuals within MU1 along the southern boundary.	Scattered plants persist near the southern boundary of the southern offset. Control work undertaken in mid to late-2013 appears to have been less successful than previously reported. Given the isolated nature of the species within the offset site, control should be a high priority. **MU occurrence**: MU1A, 2B **Recommendation**: Follow-up weed control required in accordance with weed control program outlined in the sub-plan. **Priority**: High
Blackberry (*Rubus fruticosus*)	Low, localised areas of dominance. Predominantly found within the northern offset, and was more or less restricted to the drainage lines or moist areas.	Targeted control work has been successful. Occasional isolated patches and scattered young individuals were observed in 2015, particularly in MU4 along the drainage line. It was noted that the species is abundant in the broader Williamsdale property, particularly close to the river corridor. **MU occurrence**: MU1A, 1B, 3, 4, 5, 6, 7 **Recommendation**: Follow-up control required. **Priority**: High

Species	Weed occurrence prior to current surveys (baseline)	Current status
Woody Weeds (Hawthorn, *Prunus, Pyracantha & Cotoneaster*)	Very low, isolated individuals. Present within the study area as isolated individuals.	Scattered plants persist throughout the offset site and should be removed. Plants are typically in difficult to access areas. **MU occurrence**: MU3, 4, 5, 6, 7 **Recommendation**: Targeted control of isolated individuals using cut and paint or manual removal of the tree. **Priority**: Moderate
St John's Wort (*Hypericum perforatum*)	Scattered and moderate occurrence across the offset site.	Despite control efforts, the species remains widely distributed across both the northern and southern offsets. While the species is common, cover is typically low in most instances. The species is particularly prevalent in open areas of the site. **MU occurrence**: All units **Recommendation**: Investigate control options through discussion with ACT parks and conservation. **Priority**: Low
Thistles (*Carthamus lanatus, Carduus* spp. & *Onopordum* spp.)	Moderate, localised areas of dominance.	Thistles were recorded predominantly in areas with significant history of disturbance. *Carduus* spp. were commonly encountered beneath the canopy of trees. MU1 has a substantial cover of young *Carthamus lanatus* that will become denser as the season progresses. The adjacent property to the south also has a high cover of thistles, which makes any corrective action within the offset site difficult. **MU occurrence**: MU1A, 1B, 3, 4, 6, 7 **Recommendation**: For *Carthamus lanatus* particularly, consider control options within a broader program encompassing the adjacent property. **Priority**: Moderate

Species	Weed occurrence prior to current surveys (baseline)	Current status
Sweet Briar (*Rosa rubiginosa*)	Moderate, widely distributed at low density with scattered individuals, some areas of dominance. Present across the offset site, often with larger infestations under mature trees.	Weed control work on *Rosa rubiginosa* appears to have been largely successful. However, some re-sprouting or recruitment from soil seed stores was observed and it is expected that continued follow up work for the species will be necessary **MU occurrence**: All units. **Recommendation**: Follow up spot spraying of individuals missed or re-sprouting. **Priority**: Moderate

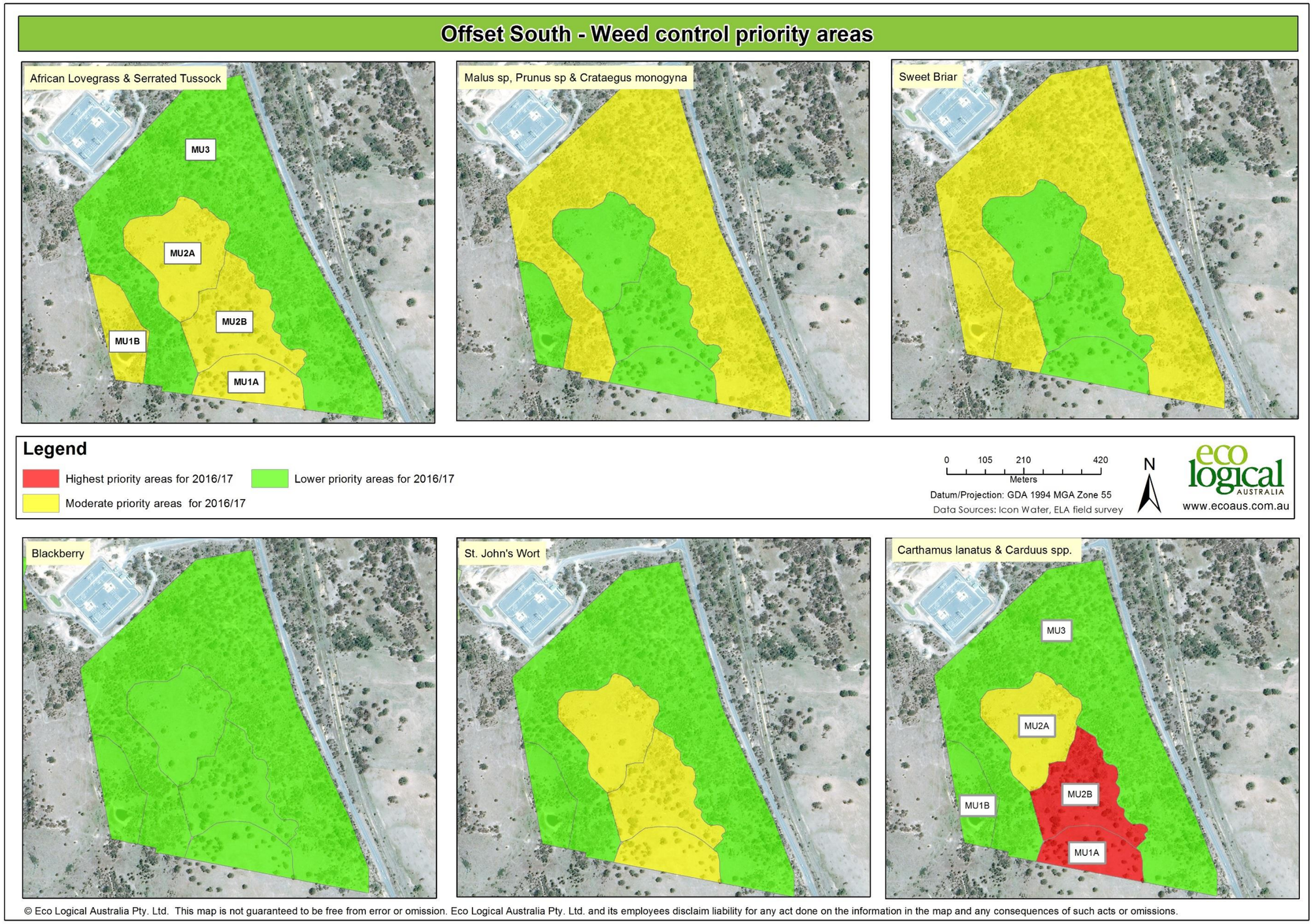


Figure 13: Relative weed distribution, southern offset

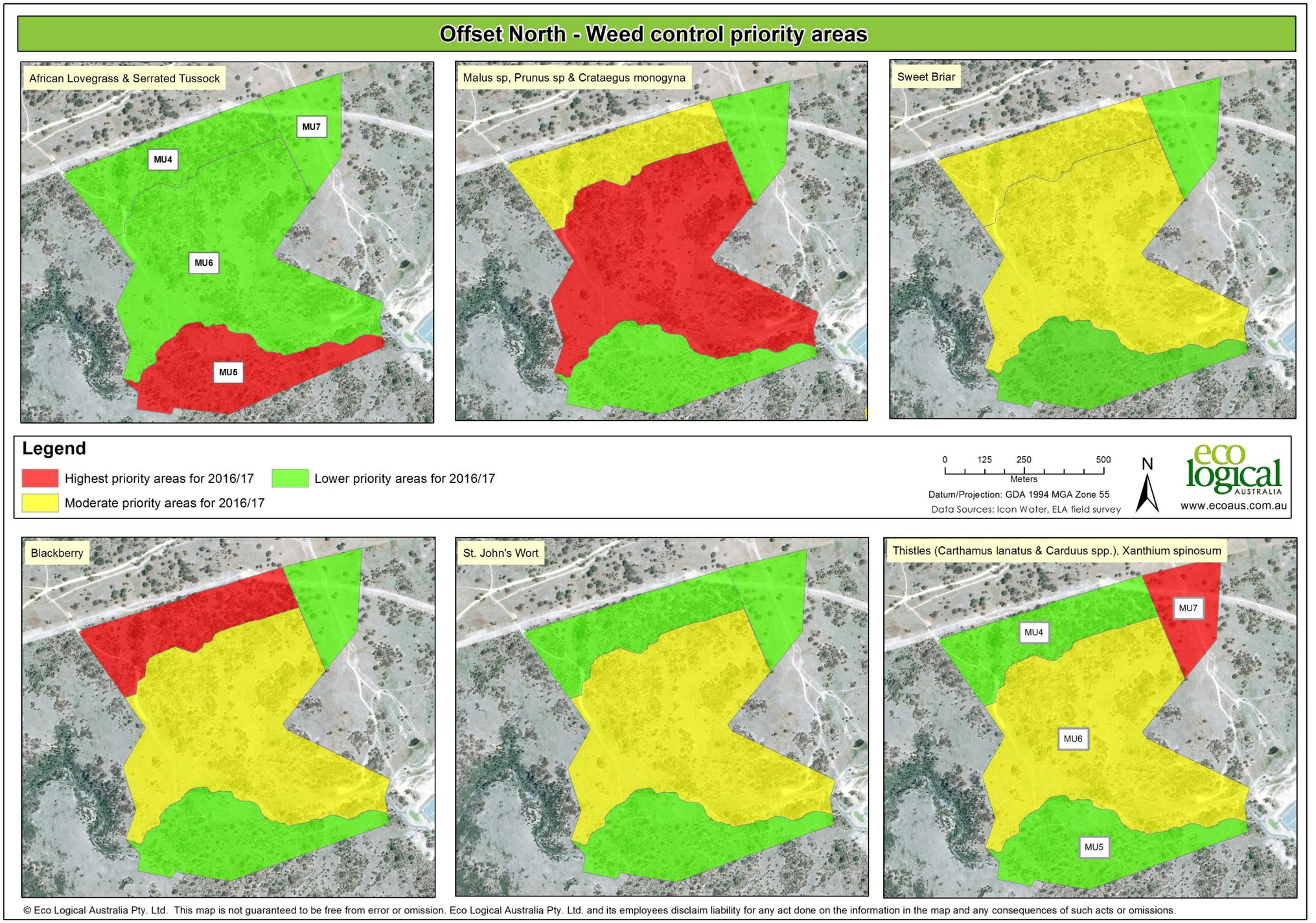


Figure 14: Relative weed distribution in the northern offset

7 Erosion monitoring

7.1 Erosion management actions undertaken to date

No on-ground erosion management activities have been undertaken to date. For further detail on management actions recommended refer to the ODP and Erosion Management Sub-plan.

During the ERG site visit to the M2G Biodiversity Offset on 22 October 2014, concern was expressed over potential erosion problems in two areas adjacent to the main drainage channel in the northern offset. The two sites are located along the main drainage line separating MU5 & MU6 within the northern offset. Recommendations around rehabilitation options were presented in the spring 2014 monitoring report. As recommended in the report, options to rehabilitate these points should be investigated.

It is recommended that a concept plan for the rehabilitation of these sites be developed and the cost of rehabilitation investigated. The erosion present along the main drainage line is unlikely to naturally self-remediate over time due to the nature of the soils within the site and the head cut nature of the erosion occurring. Without remediation, the erosion along the main drainage line will continue to progress upslope following substantial rainfall events.

7.2 Erosion monitoring point results – autumn 2015

Erosion monitoring point locations included in the spring 2015 surveys are mapped in **Figure 15** and **Figure 16**.

The majority of erosion monitoring points are located along ephemeral drainage lines in the northern offset. The erosion points are in a variety of conditions; however, vegetative cover surrounding each point is generally sufficient to limit erosion potential. While the majority of points are currently stable, remediation works are likely to be required in the future at points 7, 9 and 18 where active gully erosion is occurring. It is recommended that measures to rehabilitate these points be investigated while they are having a minor impact on the landscape. Without treatment these gullies will continue to erode and lengthen particularly after heavy rainfall events.

It should be noted that approval is required to undertake any remediation works within a drainage line (see erosion sub-plan), and may influence the type of work to be undertaken. A summary of the erosion points monitored within the offset property is provided below with a detailed description of each point and an accompanying photo.

Figure 15: Erosion monitoring points in northern offset

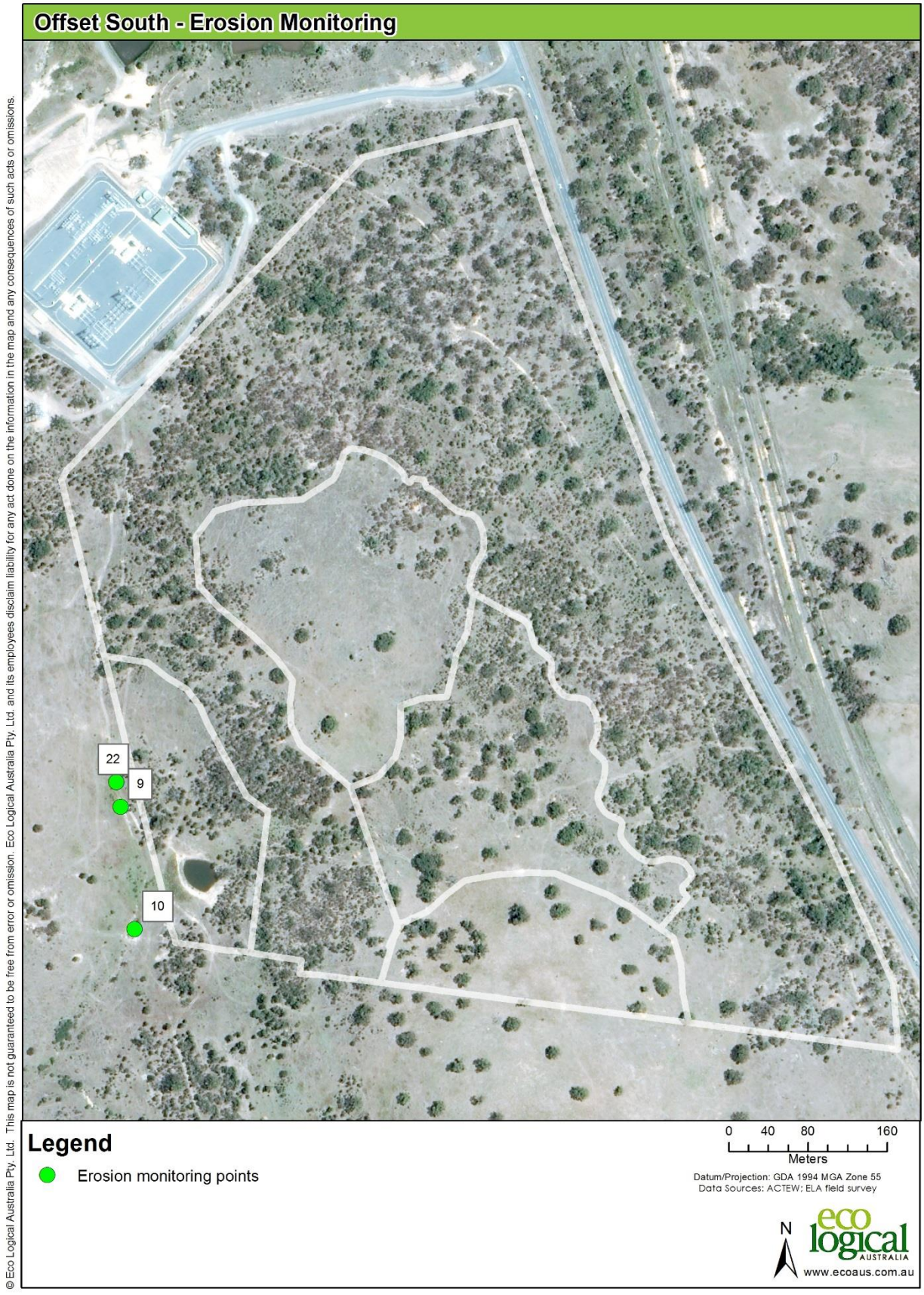


Figure 16: Erosion monitoring points in southern offset

Erosion Point 2:

Description: Situated within an ephemeral drainage line in MU4, northern offset.

Size: Approximately 4 m across, 0.8 m deep and 2.0 m in length.

Change: No significant change observed since baseline monitoring survey.

Action required: No works required at this stage.

Autumn 2012 (baseline)

Spring 2015

Erosion Point 4:

Description: Located within an ephemeral drainage line within MU4, northern offset.

Size: Approximately 2.0 m wide, 0.5 m deep, 2.5 m long.

Change: No significant change observed since baseline monitoring survey.

Action required: No works required at this stage.

Autumn 2012 (baseline)

Spring 2015

Erosion Point 6:

Description: Located within an ephemeral drainage line within MU4, northern offset. Evidence of sheet erosion along bank and some rilling.

Size: Approximately 6 m long, 1.5 m deep and 2.5 m wide.

Change: No change observed since baseline monitoring survey.

Action required: Consider removing erosion point from future monitoring surveys.

Autumn 2012

Spring 2015

Erosion Point 7:

Description: Located along the main creek line within northern offset. Photo taken from Photo Point 1 (co-ordinates; 6059835, 692700) looking north-west (315º) and showing the north bank.

Size: Approximately 20 m long and 1.0 m deep.

Change: Active erosion is occurring as water sheets off upslope area.

Action required: Remediation measures to slow surface water flow and stop progression of head cut should be considered.

Autumn 2012 (baseline)

Spring 2015

Erosion Point 8:

Description: Located along the main creek line within northern offset. Photo taken from Photo Point 1 (co-ordinates; 6059835, 692700) looking north-east (45^{o}) and showing the north bank (upstream from erosion point 7).

Size: Approximately 15 m long and 1.0 m deep.

Change: A small amount of erosion has occurred on the northern bank.

Action required: None. Expected to grade out over time and naturally revegetate.

Autumn 2012 (baseline)

Spring 2015

Erosion Point 9:

Description: Situated near the western boundary of the southern offset.

Size: Approximately 20 m long and 1 m deep.

Change: No significant change observed since baseline monitoring survey. Head cut shows small amount of active erosion.

Action required: Consider remediation of head cut to stop progress of gully.

Autumn 2012 (baseline)

Spring 2015

Erosion Point 10:

Description: Situated along the western fence line of the southern offset. Small area of erosion due to upslope runoff.

Size: Approximately 5.0 m long and 0.5 m deep.

Change: No change.

Action required: No immediate action required.

Autumn 2012 (baseline)

Spring 2015

Erosion Point 13:

Description: Moderately sized erosion point in northern offset. Evidence of existing slumping.

Size: Approximately 4.0 m long, 1.5 m deep and 2-3.5 m wide.

Change: Some minor slumping at gully head previously occurred.

Action required: No immediate action required.

Autumn 2012 (baseline)

Spring 2015

Erosion Point 18:

Description: Located along an ephemeral drainage line within the northern offset. Evidence of stream bed exposure, pooling and in-stream vegetation.

Size: Approximately1.5 m deep, 3.0 m wide, 4.0 m long.

Change: Some minor slumping and further progression of the head cut has occurred.

Action required: Measures to control head cut should be considered.

Autumn 2012 (baseline)

Spring 2015

Erosion Point 21:

Description: Located west (just downstream) from the access track running along the western boundary in the northern offset. The site has developed a plunge pool, which has exposed the bedrock in some parts.

Size: 1-2 m wide, 0.6 m deep, 1.5-3 m long.

Change: No change since previous survey.

Action required: No action is required at this stage.

Spring 2012 (baseline)

Autumn 2015 (no spring image available)

Erosion Point 22: Point established at overflow point of southern dam during the spring 2013 monitoring surveys.

Description: Southern dam overflow – flowing water causing erosion at exit point.

Size: 20 cm wide, 30 cm deep, 1.5 m long.

Change: Water over-flow from the dam has caused the erosion point to deepen and widen. This point remains susceptible to further erosion.

Action required: No works required at this stage

Spring 2013 (baseline)

Autumn 2015

8 Feral animals

The autumn and spring 2012 monitoring surveys identified *Sus scrofa* (Feral Pig) within the offset property. Prior to the autumn 2012 monitoring, this species had not been observed. Disturbance within the offset included pig rooting, often in areas associated with a forage source, and tracks through boggier areas of the site. The disturbance caused by the pigs was locally significant, but pig activity was at a low density across the whole of the offset. It was recommended that the level of disturbance be monitored and appropriate action taken if the level of disturbance increased significantly. In response to the recommendation, Regional Feral Animal Control (RFAC) was engaged to conduct control activities at the M2G offset site during 2012 and 2014.

Capra hircus (Feral Goats) were observed within the offset site during the spring 2013 monitoring surveys. The species was considered likely to be utilising a large area, including the offset site, neighbouring properties and Murrumbidgee River corridor. The lack of disturbance (agriculture activities) within the offset site is likely to provide a refuge for the goats. The spring 2013 monitoring surveys observed localised goat camps (e.g. under a stand of trees) and increased grazing pressures at these points. However, the overall quality and condition of the offset site did not appear to be impacted significantly. As a proactive measure Icon Water undertook goat control activities in December 2013. A total of 150 feral goats were removed from the offset site. Subsequent aerial monitoring did not record any goats within the offset site. RFAC observed goats within the offset site during July 2014.

8.1 Feral animal monitoring results – spring 2015

Monitoring of feral animals using opportunistic observations only was conducted during spring 2015. Surveys using remote cameras were undertaken in autumn 2015. Observations of scats and tracks belonging to feral animals were recorded.

8.1.1 *Vulpes vulpes* (European Fox)

A single fox was observed within the offset site during the spring 2015 monitoring.

8.1.2 *Oryctolagus cuniculus* (European Rabbits) and *Lepus europaeus* (Hares)

Evidence of rabbits (scats) within the offset site was observed at a number of locations. Hares have previously been recorded. Both species are thought to be free living in low numbers within the offset site with no warrens identified to date.

8.1.3 *Dama dama* (Feral Fallow Deer)

No fallow deer were recorded during the spring 2015 surveys. The species is considered likely to utilise the site periodically.

8.1.4 *Capra hircus* (Feral Goat)

No feral goats were observed in spring 2015, however a number were observed in autumn 2015 and evidence within the offset site (scats) suggests that some individuals may still be present within the site periodically.

8.1.5 *Sus scrofus* (Feral Pig)

Pig diggings and one wallow were observed within the offset site during spring 2015. The diggings do not appear to be recent. It is likely that the species utilises the offset site and adjacent areas including

the broader Murrumbidgee River corridor on a seasonal basis to escape cold weather at higher altitudes.

8.1.6 *Bos Taurus* (Cattle)

A lone unpolled Hereford male was observed in early June by Icon water personnel. Evidence of the species (scat) was observed in spring 2015.

8.2 Recommendations and actions

- Monitor Feral Goats numbers within the offset site during autumn 2016 and undertake control if more than 50 individuals are observed to be utilising the offset site.
- Liaise with Parks and Conservation Service to expand existing fox baiting programs during 2015 to include the offset site.
- Report presence of feral animal activity (for goat, pig and deer) to the local control agencies. This will assist with information that may guide any broad or landscape scale control activities.

9 Fencing monitoring

Fencing of the offset site was one of the required actions highlighted in the ODP. Fencing is required to prevent grazers, such as sheep and cattle entering the offset site from the neighbouring properties. The primary aim of a stock proof fence is to keep grazing stock out of an area (e.g. conservation area) where it is bordered by a private rural property. This type of fencing generally consists of 4 or 5 stranded wire with wooden posts and/or star-pickets, approximately 1.2 m high. In response to recommendations in previous monitoring reports, all internal fencing within the offset site was removed in June 2013 to enhance the wildlife friendly nature of the offset site, and be consistent with the biodiversity conservation ideals of the ODP and associated sub-plans.

9.1 Fence condition spring 2015

No fence maintenance has been undertaken since the previous monitoring period. All areas of fence damage observed during spring 2015 have been previously recorded (refer to **Figure 17**).

The overall condition of the Williamsdale property and offset boundary fencing is considered adequate to exclude grazing by stock within the offset site. Older style boundary fencing comprising a rabbit netting base with plain wires along the top is present along some sections of the offset site boundary. Netting fences are typical of old agricultural boundary fencing and were designed to minimise the movement of rabbits between neighbouring properties. This style of fencing is not wildlife friendly and can require considerable ongoing maintenance as a result of damage by fauna (Wombats etc.). Minor damage to fence sections of this style along the boundary has occurred where fauna (e.g. wombats, Kangaroos) have pushed up existing rabbit netting to gain access to the offset site. It is recommended that eventual replacement of this style of fencing be considered to minimise impacts to fauna and reduce management costs and maintenance required in the long term.

It is recommended that the fence continue to be monitored to ensure that it is maintained as an effective barrier to the movement of stock. It is also recommended that the gate to the Gigerline Nature Reserve remain closed to minimise the number of access points to the property.

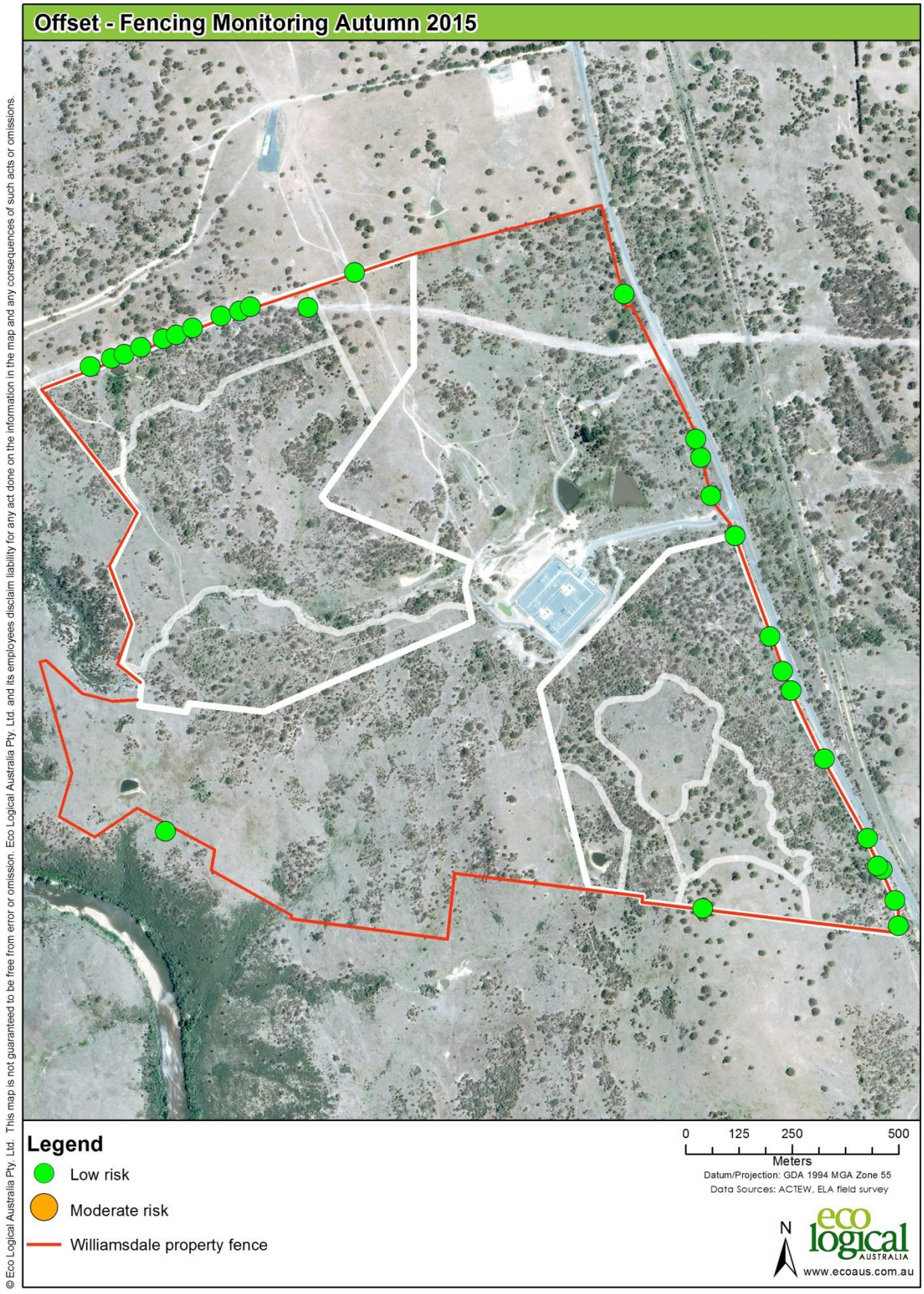


Figure 17: Williamsdale property fence with points recommended for repair

10 Summary

10.1 General

The offset site is considered to be in good condition and is providing habitat for a range of threatened, rare and uncommon flora and fauna species. The management actions implemented to date appear to be working satisfactorily; however, some on-going maintenance is required in a small number of areas.

10.2 Bushfire

The access track through the offset site is in a satisfactory condition.

Grazing levels, mainly by native herbivores, across the property are moderate which is controlling the ground layer and preventing an excessive build-up of biomass or bushfire fuels occurring.

10.3 Threatened, rare and uncommon plant species

Four nationally threatened, and 11 rare and uncommon ACT plant species occur on the offset site. Although no species is imminently threatened within the offset site it is recommended that periodic monitoring be undertaken to ensure that the populations of these species within the site are at a minimum maintained over time, and ideally expanded. Factors to consider monitoring include:

- population numbers
- evidence of recruitment
- potential threats such as grazing or browsing and weed competition.

Staff and contractors should be made aware of these species and their locations on site to minimise inadvertent damage to populations. This is particularly important for personnel involved in spraying herbicides.

10.4 Weeds

Primary control of weeds across the site has reduced the abundance and distribution of key weed species, however, follow up control is required to target any individuals missed or those that are resprouting. On-going weed control is still required within the offset site for species such as African Lovegrass, Serrated Tussock, Sweet Briar, Blackberry, Hawthorn, *Prunus* sp., and *Pyracantha* sp.

Priority species and priority areas for management are outlined in this report.

It is recommended that weed control within the broader Williamsdale property be considered to minimise the chance of weed propagules from surrounding land becoming established within the offset site.

10.5 Erosion

Three erosion points show signs of active gully erosion and will require remediation work in the future. It is recommended that concept plans to undertake remediation of these sites be developed and the cost of rehabilitation works be investigated.

10.6 Feral animal

The overall incidence of feral animals within the offset site was low. Evidence of common species such as Rabbits and Foxes was observed within the offset site. The presence of goats, pigs and a cow was also recorded, however it is considered likely that goats and pigs utilise the site on a seasonal basis. Continued monitoring is recommended.

10.7 Fencing

The condition of the Williamsdale property and offset boundary fencing is considered adequate to exclude stock grazing from the offset site, however, some minor repairs are likely to be required. Some sections of the fence may require replacing in the future with a five strand plain wire fence.

10.8 Grazing

It is estimated that up to 100 kangaroos may be utilising the offset site and surrounding properties at any one time. The LMA (ACT Government) for the Williamsdale property does not outline a suitable grazing level for the 'Active Conservation' rural enterprise. Previously, the grazing intensity for the Williamsdale property was set at a Dry Sheep Equivalent (DSE) of 600.

The ACT Kangaroo Management Plan (ACT Government, 2010) indicates that a direct comparison between sheep and kangaroos in terms of DSE is inaccurate due to inherent ecological differences between the two species. However, the Kangaroo Management Plan (KMP) suggests that a DSE of 0.6 per kangaroo for an unharvested population is probably a reasonable comparison for the ACT region. Using this DSE, the Williamsdale property has the capacity to support up to 360 Kangaroos. An alternative measure to calculate the number of Kangaroos that a property can support is to look at the relative density. The KMP suggests a density of between 0.6 and 1.5 Kangaroos per hectare. The Williamsdale property is approximately 208 ha in size, which means that using the density calculation, the property could support between 124 – 312 kangaroos in total.

Opportunistic observations of grazing pressure within and adjacent to the *Swainsona recta* exclosure plots indicate that the offset site is currently grazed at moderate to high intensity, which is broadly consistent with the conservations principles outlined in the ODP. Grazing pressure within the offset site appears to be slightly higher than recorded during recent survey periods and control of grazing macropod numbers may be required to ensure that an appropriate level of cover is maintained particularly going into autumn. It is recommended that Icon Water discuss grazing pressure with ACT Parks and Conservation staff to determine whether control of grazing macropods is required.

11 Management recommendations

A summary of the recommended adaptive management actions relating to the offset site is provided in **Table 13** below. The actions relate to the appropriate ODP sub-plan and are based on the results presented in the above sections.

Table 13: Summary of proposed actions relating to the ODP

ODP Sub-Plan	Action status	Recommended management actions
Weed	On-going control and monitoring.	No additional recommendations following the spring 2015 monitoring period. Previous reports recommended the following: • Target priority species and priority areas over the 2016/17 period. • Continue to undertake follow up weed control as required on persistent species such as Sweet Briar. • On-going weed management will be required at the site to combat the introduction of propagules from adjacent rural areas.
Rehabilitation	To be considered.	No additional recommendations following the spring 2015 monitoring period. The spring 2014 report recommended the following: • It is recommended that consideration be given to low density scattered plantings in MU7. Plantings should include over storey (*Eucalyptus blakelyi, E. melliodora*) and shrubs such as, *Bursaria spinosa, Acacia spp., Cassinia sp., and Dodonaea sp*. Plantings need to consider the proximity to the powerlines and need to maintain an appropriate easement. Within the powerline easement consideration could be given the plantings of low shrubs, forbs and native grasses. Rehabilitation works could trial the use of Kangaroo Grass mulch to suppress weeds and introduce seed into the site. • Prior to any planting works, weed control needs to be undertaken, particularly for broad leaf exotic species. Plantings should be monitored to ensure that they are not outcompeted by exotic annual grass growth during the growing season. • Box-Gum Woodland, the dominant vegetation community within MU7 is an open woodland community with a typically absent or scattered mid-storey of native shrubs. Any plantings considered should mimic the structure and species diversity present in the remainder of the offset site. There are likely to be suitable locations to collect seed within the offset site to ensure that local provenance is preserved.
Sediment and erosion Control	Action required.	• The majority of sites within the offset are considered to be stable and no immediate action is required. • Concept plans should be developed for remediation works at points 7, 9 and 18. The cost of remediation activities should be investigated.
Bushfire	Complete. On-going monitoring.	• It is recommended that the track continues to be maintained in a condition to facilitate bush fire management. If track management is required in the future, it is recommended that care is taken to ensure that the track remains in good condition and does not widen due to overuse, incorrect maintenance, or result in erosion. The track would ideally remain in a grassed condition. Applicable to MU's 3, 4 & 6. • Consider developing and implementing an improved bushfire management plan which specifically manages the site for conservation. The plan should include consideration of fire as a tool to manage invasive species, increase native species diversity, maintain an open structure to the woodland and enable a mosaic of fire classes to be established across the site.
Feral animal control	Action and on-going monitoring required.	• Implement a fox baiting program during 2015 • Rabbit numbers are currently low, but they could increase with fox control. It is recommended that both species are monitored post control. Continue biannual monitoring of all feral animals to establish if control activities are required in the future. Applicable to all Management Units. • Monitor pig and goat populations in 2016 and implement control if more than 50 individuals are recorded (goats) or 15 individuals (pigs).
Fencing	Completed in August 2012 and June 2013. On-going maintenance and monitoring	• No immediate major actions required. • Replacement of older style boundary fence (rabbit netting) with a 5 strand plain wire fence should be considered.
Grazing	On-going monitoring	• Grazing level is considered to be appropriate to the management objectives of the site. Grazing should be continually monitored and control measures considered if necessary. • It is recommended that advice be sought from ACT government regarding grazing pressure and the potential control options for native herbivores.

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Appendix A: Flora species list – monitoring plots

D = dead

+ = few, small cover (<5%)

r = solitary, small cover (<5%)

1 = numerous (up to 5%)

2 = 5-25%

3= 25-50%

4= 50-75%

5=>75%

Note: The species cumulative list includes all species observed over all monitoring surveys.

Native species

Plot Number	Opportunistic	1	2	3	4	5	6	7	8
Species (cumulative list)	**Spring 2015**	**MU1A**	**MU2B**	**MU3**	**MU4**	**MU5**	**MU6**	**MU7**	**MU3**
Acacia dealbata	x								
Acacia mearnsii									
Acacia rubida	x								
Acaena novae-zelandiae									
Acaena echinata	x				+	+			
Acaena ovina	x		1	1	1	+	1		+
Acrotriche serrulata	x								
Ajuga australis	x								
Alternanthera denticulata									

Plot Number	Opportunistic	1	2	3	4	5	6	7	8
Species (cumulative list)	**Spring 2015**	**MU1A**	**MU2B**	**MU3**	**MU4**	**MU5**	**MU6**	**MU7**	**MU3**
Alternanthera sp. A	x	r						r	
Amphibromus nervosus									
Amyema pendula subsp. *pendula*	x								
Aphanes australiana									
Aristida ramosa	x								+
Arthropodium minus	x		r						+
Arthropodium sp.									
Asperula conferta	x		1	1	2	1	+		1
Asplenium flabellifolium	x								
Astroloma humifusum									
Austrostipa bigeniculata					+				
Austrostipa densiflora									
Austrostipa scabra	x	1	2	1		+	2		2
Austrostipa setacea	x								
Austrostipa sp.									
Bossiaea buxifolia	x								
Bossiaea prostrata	x					+			
Bothriochloa macra	x	1	2		+		2	r	
Brachycome sp.	x								
Brachyloma daphnoides	x								
Brachyscome dentata									
Bulbine bulbosa	x		r	r		1			1
Bursaria spinosa subsp. lasiophylla	x		r	r					
Callistemon sieberi	x								
Callitris endlicheri	x								

Plot Number	Opportunistic	1	2	3	4	5	6	7	8
Species (cumulative list)	**Spring 2015**	**MU1A**	**MU2B**	**MU3**	**MU4**	**MU5**	**MU6**	**MU7**	**MU3**
Calocephalus citreus	x			r					
Calotis scabiosifolia var. integrifolia	x								
Carex appressa	x							r	
Carex breviculmis	x							1	
Carex inversa	x	1	1	+	1	+	+		
Carex sp.									
Cassinia aculeata									
Cassinia quinquefaria	x						r		
Cassinia longifolia									
Centipeda cunninghamii									
Cheilanthes sieberi	x		1	r		1			1
Chrysocephalum apiculatum	x		2	2		2	1		2
Chrysocephalum semipapposum	x						+		
Clematis leptophylla	x				r		r		
Convolvulus angustissimus	x	r	1	r		1	+		+
Cotula australis	x	r							
Craspedia variabilis	x				1				
Crassula helmsii									
Crassula peduncularis									
Crassula sieberana	x	1					1	1	1
Cryptandra amara	x					+	r		
Cymbonotus lawsonianus									
Cymbonotus preissianus									
Cymbonotus sp.	x		1	+	+	1	1	+	+
Cymbopogon refractus	x		+	r			+		

Plot Number	Opportunistic	1	2	3	4	5	6	7	8
Species (cumulative list)	**Spring 2015**	**MU1A**	**MU2B**	**MU3**	**MU4**	**MU5**	**MU6**	**MU7**	**MU3**
Cynoglossum suaveolens	x								
Cyperus lhotskyanus									
Daucus glochidiatus	x					+	+		r
Desmodium brachypodium	x								
Desmodium varians	x	r	1	r		+	1		+
Dianella revoluta	x								
Dichelachne sp.	x				r				
Dichelachne micrantha									
Dichondra repens	x		1		r	1			
Dichopogon fimbriatus									
Dillwynia sp. Yetholme									
Discaria pubescens	x								
Diuris semilunulata									
Dodonaea viscosa subsp. angustissima	x								
Drosera peltata	x								
Dysphania pumilio									
Einadia nutans subsp. *nutans*							+		
Elatine gratioloides									
Eleocharis acuta	x								
Elymus scaber	x		r	1	r	1			
Enneapogon nigricans							r		
Epilobium billardiereanum									
Epilobium hirtigerum									
Eragrostis brownii									
Erodium crinitum	x							+	

Plot Number	Opportunistic	1	2	3	4	5	6	7	8
Species (cumulative list)	**Spring 2015**	**MU1A**	**MU2B**	**MU3**	**MU4**	**MU5**	**MU6**	**MU7**	**MU3**
Eryngium ovinum	x			1	r				
Eucalyptus blakelyi	x		2	3					
Eucalyptus bridgesiana	x								
Eucalyptus dives	x								
Eucalyptus mannifera	x								
Eucalyptus melliodora	x	r							
Eucalyptus rossii									
Euchiton japonicus	x		+	+			1		+
Euchiton sphaericus	x	r	1			+		r	
Euchiton sp.									
Euphorbia drummondii	x	r							
Fimbristylis dichotoma									
Galium gaudichaudii	x					+			
Geranium retrorsum	x					1	+		
Geranium solanderi	x		1	1	1	1	1		
Geranium sp.									
Glossostigma elatinoides	x								
Glycine clandestina	x		r				r		
Glycine tabacina	x	r	1	r		+			+
Gonocarpus tetragynus	x								1
Goodenia hederacea									
Goodenia pinnatifida				1					
Haloragis heterophylla	x								
Hibbertia obtusifolia	x								
Hydrocotyle laxiflora	x	r	1	1	1	1	r	+	r

Plot Number	Opportunistic	1	2	3	4	5	6	7	8
Species (cumulative list)	**Spring 2015**	**MU1A**	**MU2B**	**MU3**	**MU4**	**MU5**	**MU6**	**MU7**	**MU3**
Hymenochilus cynocephalus	x								
Hypericum gramineum	x		+	1	1	+			+
Hypoxis hygrometrica									
Indigofera australis	x								
Isoetopsis graminifolia									
Isolepis hookeriana									
Isotoma fluviatilis subsp. *australis*									
Juncus australis	x								
Juncus bufonius									
Juncus filicaulis				r	1				
Juncus homalocaulis									
Juncus subsecundus	x	r						1	
Juncus ?usitatus									
Kunzea ericoides	x		r						
Kunzea parvifolia									
Lachnagrostis filiformis									
Leptorhynchos squamatus	x			1	1	1	r		1
Leptospermum continentale	x								
Leucochrysum albicans var. *tricolor*	x								+
Limosella australis									
Linum marginale									
Linum trigynum L.									
Lomandra bracteata									
Lomandra filiformis subsp. *coriacea*	x		r				r		r
Lomandra filiformis subsp. *filiformis*					+				

Plot Number	Opportunistic	1	2	3	4	5	6	7	8
Species (cumulative list)	**Spring 2015**	**MU1A**	**MU2B**	**MU3**	**MU4**	**MU5**	**MU6**	**MU7**	**MU3**
Lomandra longifolia									
Lomandra multiflora	x					r			
Luzula densiflora		r		r	+				+
Lythrum hyssopifolia									
Melichrus urceolatus	x					+			r
Microlaena stipoides	x		1	1	2	2	r		
Microseris lanceolata	x					r			
Microtis sp.	x				1	r			
Montia fontana subsp. chondrosperma									
Myosotis australis							1		+
Ophioglossum lusitanicum									
Oreomyrrhis eriopoda	x								
Oxalis sp.									
Oxalis perennans	x	r	+		r		+	r	
Oxalis radicosa									
Oxalis thompsoniae									
Panicum effusum	x	1	1		1	1	1		
Pellaea calidirupium									
Persicaria prostrata									
Pimelea curviflora	x					r			
Plantago gaudichaudii	x			1		r			
Plantago varia	x			1		r			
Poa labillardieri	x								
Poa sieberiana var. hirtella									
Poa sieberiana var. *sieberiana*	x		r	+	+	1			

Plot Number	Opportunistic	1	2	3	4	5	6	7	8
Species (cumulative list)	**Spring 2015**	**MU1A**	**MU2B**	**MU3**	**MU4**	**MU5**	**MU6**	**MU7**	**MU3**
Poa sp.									
Pomaderris angustifolia									
Pomaderris pallida	x								
Poranthera microphylla	x		r						
Potamogeton ochreatus									
Pseudognaphalium luteoalbum	x								
Pultenaea procumbens	x								
Ranunculus lappaceus	x				r				
Ranunculus pumilio var. *pumilio*									
Ranunculus sessiliflorus var. *sessiliflorus*	x				+				
Rhodanthe anthemoides									
Rubus parvifolius	x								
Rumex brownii	x	1	+	+	+			1	
Rytidosperma caespitosum	x		+						
Rytidosperma carphoides									
Rytidosperma laeve									
Rytidosperma pallidum									
Rytidosperma racemosum	x	1	1						
Rytidosperma sp.				+					
Schoenus apogon	x				2				r
Scleranthus diander	x								
Scleranthus fascicularis									
Sebaea ovata	x					+			
Senecio phelleus									
Senecio quadridentatus	x					r	r		

Plot Number	Opportunistic	1	2	3	4	5	6	7	8
Species (cumulative list)	**Spring 2015**	**MU1A**	**MU2B**	**MU3**	**MU4**	**MU5**	**MU6**	**MU7**	**MU3**
Solanum linearifolium									
Solanum ?nigrans	x						r		
Solenogyne dominii	x		1		1	+			1
Solenogyne gunnii	x				1				
Sporobolus sp.									
Stackhousia monogyna	x			1		1			1
Stellaria pungens	x						r		
Stylidium despectum									
Swainsona monticola	x								
Swainsona recta (propagated)	x								
Swainsona sericea	x			1		1			
Thelymitra pauciflora									
Thelymitra sp.	x								
Themeda triandra	x			2	3	3	r		2
Thysanotus patersonii	x								
Thysanotus tuberosus									
Tricoryne elatior									
Tripogon loliiformis	x								
Triptilodiscus pygmaeus	x		1	+	+	+	1		1
Veronica calycina	x		1			+			
Veronica sp.									
Vittadinia cuneata	x		1			+			
Vittadinia gracilis	x						+		
Vittadinia muelleri	x		1				1		1
Wahlenbergia communis	x		+	+		1	r		1

Plot Number	Opportunistic	1	2	3	4	5	6	7	8
Species (cumulative list)	**Spring 2015**	**MU1A**	**MU2B**	**MU3**	**MU4**	**MU5**	**MU6**	**MU7**	**MU3**
Wahlenbergia gracilenta	x			+					
Wahlenbergia gracilis	x					r	r		1
Wahlenbergia multicaulis	x								
Wahlenbergia sp.									
Wahlenbergia stricta									
Wurmbea dioica	x		+	r	1	1	r		1
Xerochrysum viscosum	x								1
Zornia dyctiocarpa	x								

Exotic species

Plot Number	Opportunistic	1	2	3	4	5	6	7	8
Species (cumulative list)	**Spring 2015**	**MU1A**	**MU2B**	**MU3**	**MU4**	**MU5**	**MU6**	**MU7**	**MU3B**
Acetosella vulgaris	x		1				1	1	
Aira caryophyllea									
Aira elegantissima									
Aira sp.	x	1	1	1	1	1	1	1	1
Anagallis arvensis	x		r				r		
Arctotheca calendula									
Avena barbata	x			1					
Briza maxima	x								
Briza minor	x			+	1	1			1
Bromus diandrus	x		r	1	1		1	1	
Bromus hordeaceus	x	2	1	1	1	1	1	2	
Bromus rubens	x						r		

Plot Number	Opportunistic	1	2	3	4	5	6	7	8
Species (cumulative list)	**Spring 2015**	**MU1A**	**MU2B**	**MU3**	**MU4**	**MU5**	**MU6**	**MU7**	**MU3B**
Bromus sp.									
Capsella bursa-pastoris	x	r						1	
Carduus pycnocephalus	x		r					1	
Carduus tenuiflorus									
Carduus sp.									
Carthamus lanatus	x	3							
Centaurea melitensis									
Centaurium erythraea	x		+	1		1	1		1
Cerastium glomeratum	x	1		+				r	
Chondrilla juncea	x						r		
Cicendia quadrangularis	x								
Cirsium vulgare	x			r	r	r		+	
Conyza sp.	x				r	+			
Conyza bonariensis									
Conyza sumatrensis									
Cotoneaster sp.	x								
Crataegus monogyna	x								
Cynodon dactylon	x								
Cynosurus echinatus	x			+					
Cyperus eragrostis	x							r	
Cyperus lhotskyanus									
Cyperus sp.									
Echium plantagineum	x								
Eleusine tristachya (Lam.) Lam.									
Eragrostis cilianensis									

Plot Number	Opportunistic	1	2	3	4	5	6	7	8
Species (cumulative list)	**Spring 2015**	**MU1A**	**MU2B**	**MU3**	**MU4**	**MU5**	**MU6**	**MU7**	**MU3B**
Eragrostis minor									
Eragrostis curvula	x			r	r			r	
Erodium botrys	x								
Erodium cicutarium	x	1					r	r	
Erodium moschatum									
Erodium sp.									
Festuca arundinacea									
Galium aparine									
Galium divaricatum	x			r					+
Geranium molle									
Hedypnois rhagadioloides subsp. cretica									
Hirschfeldia incana									
Holcus lanatus	x								
Hordeum glaucum	x	+						1	
Hordeum leporinum									
Hypericum perforatum	x		r	+	1	1	1		1
Hypochaeris glabra	x	2	1	1	1		1	1	1
Hypochaeris radicata	x		1	1	1	1	1	1	
Isolepis levynsiana									
Isolepis marginata									
Juncus capitatus	x								
Lactuca serriola	x			r					
Lepidium sp.	x								
Linaria arvense	x		1			1	1		r
Linaria pelisseriana	x			r		1			1

Plot Number	Opportunistic	1	2	3	4	5	6	7	8
Species (cumulative list)	**Spring 2015**	**MU1A**	**MU2B**	**MU3**	**MU4**	**MU5**	**MU6**	**MU7**	**MU3B**
Linum trigynum L.									
Lolium perenne									
Lolium rigidum									
Malva nicaeensis									
Malva parviflora	x							+	
Marrubium vulgare	x								
Medicago arabica									
Modiola caroliniana	x							r	
Moenchia erecta	x						r	1	
Nassella trichotoma	x	1							
Onopordum acanthium									
Orobanche minor	x		r						
Parentucellia latifolia	x		+		+				+
Paronychia brasiliana	x	1	+				1	1	
Paspalum ?dilatatum	x								
Pentaschistis airoides									
Petrorhagia nanteuilii	x	1	+	1	+		1		
Phalaris aquatica									
Plantago lanceolata	x		+	1	1	1	1	1	
Poa annua	x							1	
Poa pratensis	x				1				
Polygonum aviculare									
Prunus sp.	x								
Pyracantha sp.									
Reseda luteola									

Plot Number	Opportunistic	1	2	3	4	5	6	7	8
Species (cumulative list)	**Spring 2015**	**MU1A**	**MU2B**	**MU3**	**MU4**	**MU5**	**MU6**	**MU7**	**MU3B**
Rosa rubiginosa	x	1		+	r	r	r	+	r
Romulea rosea var. *australis*									
Rubus fruticosus	x	r			r				
Sanguisorba minor	x								
Setaria parviflora									
Sherardia arvensis									
Sisymbrium orientale									
Sisyrinchium sp. A									
Solanum nigrum	x								
Sonchus asper				r					
Sonchus oleraceus									
Spergularia rubra	x							+	
Stellaria media	x							r	
Taraxacum officinale	x								
Tolpis umbellata	x		r	r			1		1
Tragopogon dubius	x						r		
Trifolium arvense	x	r	r	1		+	1		+
Trifolium angustifolia	x			r	1				
Trifolium campestre	x				1	1	1		1
Trifolium cernuum									
Trifolium dubium	x	r	1	+				+	
Trifolium glomeratum	x								r
Trifolium repens									
Trifolium sp.									
Trifolium subterraneum	x	3	r		+		r	3	

Plot Number	Opportunistic	1	2	3	4	5	6	7	8
Species (cumulative list)	**Spring 2015**	**MU1A**	**MU2B**	**MU3**	**MU4**	**MU5**	**MU6**	**MU7**	**MU3B**
Urtica urens	x							r	
Verbascum thapsus	x		r					r	
Verbena ?incompta	x				1			r	
Veronica anagallis-aquatica									
Veronica arvensis									
Vicia sativa									
Vulpia bromoides									
Vulpia muralis	x	+	1		1				
Vulpia myuros	x								
Vulpia sp.						1	1	2	1

Appendix B: Post-burn monitoring (*S. recta* plot)

Plot 1

The understorey is dominated by *Themeda triandra*. Less dominant species include the native *Gonocarpus tetragynus* and introduced annuals *Aira* sp., *Hypochaeris glabra* and *Vulpia* sp.

Approximately 60% of plot 1 was burned during June 2015, with the remaining 40% left un-treated. However, the fencing was not replaced around the plot following the burn as was originally intended. As such, both the treated and un-treated areas were subjected to grazing pressure by native herbivores. Evidence of grazing was present on some *S. recta* individuals.

A comparison of pre and post burn surveys for plot 1 is outlined below.

- The portion of the plot treated (burnt) contains 24 *Swainsona* planting sites. In spring 2014, live plants were observed at only six of the 24 planting sites. Comparatively, in spring 2015, live plants were observed at 12 of the 24 planting sites (increase of 50% since spring 2014).
- Of the three treated quadrats surveyed in May 2015, only one *S. recta* was located (D4). Comparatively, in spring 2015, two S. recta individuals were recorded within treated quadrats (D4 and G4)
- Sixteen *Swainsona* planting sites are located within the un-treated area with a total of seven live plants observed in spring 2014. Comparatively, in spring 2015 five S. recta individuals were recorded.
- Of the three un-treated quadrats surveyed in May 2015, one *S. recta* was located at a planting site (G2). In spring 2015, two individuals were recorded (G2 and D2).

Plot 2

The understorey is mostly dominated by *Themeda triandra* with patches of *Bothriochloa macra* and *Austrostipa scabra*. Frequently occurring species with low cover include the natives *Cheilanthes sieberi*, *Desmodium varians*, *Ophioglossum lusitanicum*, *Tripogon loliiformis* and *Wahlenbergia* sp., and introduced annuals *Hypochaeris glabra* and *Trifolium* sp.

The fence surrounding plot 2 was reconfigured on 11 May 2015 so that approximately 60% of the area of the plot was opened to grazing, whilst 40% of the plot remained free from grazing. A comparison of pre and post burn surveys for plot 2 is outlined below.

- The treated area (grazed) contains 22 *Swainsona* planting sites. In spring 2014, live plants were observed at six of the 22 planting sites. In spring 2015 following grazing, only three individuals were present (50% reduction since spring 2014).
- Of the three treated quadrats surveyed in May 2015 no *S. recta* were recorded. However, in spring 1 individual was observed (D4).
- The un-treated area contains 14 *Swainsona* planting sites with a total of three live plants observed in spring 2014. In spring 2015, only two plants were observed (reduction of 30%).
- Of the three un-treated quadrats surveyed in May 2015 no *S. recta* were observed. No individuals were observed in spring 2015 either.

Plot 3

The understorey is dominated by *Themeda triandra* with infrequent patches of *Bothriochloa macra.* Frequently occurring species with low cover include the natives *Desmodium varians*, *Gonocarpus*

tetragynus, *Leptorhynchos squamatus*, and *Microseris lanceolata*, and introduced annuals *Centaurium erythraea*, *Hypochaeris glabra* and *Vulpia* sp.

Approximately 60% of Plot 3 was burned with the remaining 40% un-treated. As with Plot 1, the fencing was not fully replaced following treatment and as such both treated and un-treated areas were subject to grazing by native herbivores.

- The treated area contains 21 *Swainsona* planting sites. In spring 2014, live plants were observed at five of the 21 planting sites. Following treatment, 8 plants were recorded in spring 2015 (increase of 60%).
- Of the three treated quadrats surveyed in May 2015, no S. recta were recorded and no S. recta were recorded following treatment in spring 2015.
- The un-treated area contains 13 *Swainsona* planting sites, with a total of three live plants observed in spring 2014 and three in spring 2015 (no change).
- Of the three un-treated quadrats surveyed in May 2015, no *S. recta* were recorded and none were recorded in spring 2015.

Photo 1: Plot 1 A2

Photo 2: Plot 1 A4 (treated)

Photo 3: Plot 1 D2

Photo 4: Plot 1 D4 (treated)

Photo 5: Plot 1 G2

Photo 6: Plot 1 G4 (treated)

Photo 1: Plot 2 A2

Photo 2: Plot 2 A4 (treated)

Photo 3: Plot 2 D2

Photo 4: Plot 2 D4 (treated)

Photo 5: Plot 2 G2

Photo 6: Plot 2 G4 (treated)

Photo 1: Plot 3 A2 (treated)

Photo 2: Plot 3 A4

Photo 3: Plot 3 D2 (treated)

Photo 4: Plot 3 D4

Photo 5: Plot 3 G2 (treated)

Photo 6: Plot 3 G4

Table 14 Cover abundance data - Post-burn *Swainsona recta* plot monitoring

	Species	1/A2	1/A4	1/D2	1/D4	1/G2	1/G4	2/A2	2/A4	2/D2	2/D4	2/G2	2/G4	3/A2	3/A4	3/D2	3/D4	3/G2	3/G4
	Treated?		YES		YES		YES		YES		YES		YES	YES	YES	YES			
	Total vegetation cover	50	50	60	55	90	50	70	80	85	90	70	55	75	95	50	80	35	85
	Litter	25	20	20	20	80	25	10	15	9	5	10	25	10	5	27	10	19	10
	Cyptogam cover	2	0	5	5	0	5	5	0	1	0	5	15	7	0	3	0	1	2
	Bare ground	23	30	15	20	2	20	15	5	5	5	15	5	8	0	20	10	15	3
	Photos	927	928	984	985	986		921	922	924	924	925	926		914	915	916	917	918
	Acaena sp.					r	r									r			
*	*Acetosella vulgaris*																		
*	*Aira* sp.	2	1	2	1	r	1	1	1	+	+	1	1	1	+		+	+	1
	Aristida ramosa																		+
	Arthropodium minus	r							r	r	r			r	r	r	r	+	
	Asperula conferta	r		1	2					2	+								
	Austrostipa scabra			+				3	+	r	r	+	+						+
	Bothriochloa macra				+			2	+		3	+	2						
*	*Briza minor*		+					1	r	r	1			+					
	Bulbine bulbosa														r				
	Carex breviculmis		+																
*	*Centaurium erythraea*			+	r	+			r					1	r	1	1	1	
	Cheilanthes sieberi							r	+	r	+	r							
	Chrysocephalum apiculatum	r		1	r			r			r			r	r			+	+
	Convolvulus angustissima								r		r								
	Crassula sieberiana	r	r		r		r	r	r		r	r	1						
	Cymbonotus sp.							r	r	r	+							r	
	Daucus glochidiatus					r													r
	Desmodium varians	r			r	+	r	r	+		+	r	1	r	+	+	+	+	+
	Dichelachne sp.														r				
	Elymus scaber	+		r	+	+		+	r			1	1						
	Enneapogon nigricans																		
	Eriochilus cucullatus																		
	Eryngium ovinum				+														r
	Eucalyptus blakelyi				2	2													
	Eucalyptus bridgesiana					1													
	Euchiton sphaericus	r				r	+											+	+
	Euchiton japonicus					1				r	r	r				r		+	+
*	*Galium divaricatum*					+	+	+	+	+	1	1	1	r	r	+	+	+	r
	Geranium retrorsum															r	r	+	r
	Geranium sp.																		
	Glycine tabacina				r														
	Gonocarpus tetragynus	1	1	2	2	1	+							r	r	+	+	1	r
	Haloragis heterophylla							r				r				+			
	Hydrocotyle laxiflora																		

	Species	1/A2	1/A4	1/D2	1/D4	1/G2	1/G4	2/A2	2/A4	2/D2	2/D4	2/G2	2/G4	3/A2	3/A4	3/D2	3/D4	3/G2	3/G4
	Hypericum gramineum	r	+		+	2			+	+	+	1	r		+		r	r	+
	Hypericum ?japonicum																		
*	*Hypericum perforatum*					r		r											
*	*Hypochaeris glabra*			+	+		+	1	1	+	1	1		+	+	1	1		r
*	*Hypochaeris radicata*		+	+			r		r				1						
*	*Juncus capitatus*	r		r															
	Leptorhynchos squamatus	r												1	r	+	r	+	+
*	*Linaria arvensis*												1					+	r
*	*Linaria pelisseriana*		r					1	+	+	+								
	Lomandra filiformis ssp. coriacea		r	r	r	r	r				r	1	r			r			r
	Luzula densiflora														r	r		r	+
	Microlaena stipoides																		+
	Microseris lanceolata													1	1	+	+	+	
	Microtis sp.					r			+					r	r	r	r	r	r
*	*Moenchia erecta*							+											
	Ophioglossum lusitanicum																		
	Oxalis sp.					r			r	r		r	r						
	Panicum effusum							r											
*	*Paronychia brasiliana*																		
*	*Petrorhagia nanteuilii*						r	+		r	+	r	+						
*	*Plantago varia*	r																	r
	Poa labillardierei																		r
	Poranthera microphylla											r	r						
	Pterostylis cyanocephalus																		r
	Rytidosperma sp.																		
	Sebaea ovata			+	r	r				+				+			r	r	
	Schoenus apogon	+		+		r						r		r					r
	Solenogyne dominii											r			r				
	Swainsona recta			r	r	r	r				r								
	Thelymitra sp.																r		
	Themeda triandra	3	3	3	2	5	3	1	2	5	3	2		4	5	3	5	3	
*	*Tolpis umbellata*							r	+	+	1	r	+						
	Tricoryne elatior																		
*	*Trifolium angustifolium*					r		1	1	+	2		1						
*	*Trifolium arvense*	+				r					+		r				1	r	r
*	*Trifolium campestre*			r	r			2	+	1									
*	*Trifolium* sp.		+					r				+		r	r	r			r
	Tripogon loliiformis												2						
	Triptilodiscus pygmaeus	2	r	+	1			+	r	+	1	2	2					+	r
	Vittadinia muelleri							+	r			1	+						
*	*Vulpia* sp.	1		+					1	+		+	+	r			+	r	
	Wahlenbergia sp.				r			r	+		r							r	
	Wahlenbergia gracilenta							r											

	Species	1/A2	1/A4	1/D2	1/D4	1/G2	1/G4	2/A2	2/A4	2/D2	2/D4	2/G2	2/G4	3/A2	3/A4	3/D2	3/D4	3/G2	3/G4
	Wahlenbergia gracilis															r			
	Wahlenbergia communis			r		r						+	+			r			+
	Wurmbea dioica								r		r				r	r	r	r	r

Appendix C: Flora plates – Rare and uncommon species

Photo 1: Hoary Sunray (*Leucochrysum albicans var. tricolor*)

Photo 2: Pale Pomaderris (*Pomaderris pallida*)

Photo 3: Hairy Anchor Plant (*Discaria pubescens*)

Photo 4: *Swainsona monticola*

Photo 5: *Zornia dyctiocarpa*

Photo 6: *Bossiaea prostrata*

Photo 7: *Stylidium despectum*

Photo 8: *Glossostigma elatinoides*

Photo 9: *Thesium australe*

Photo 10: *Desmodium brachypodum*

Appendix D: Fauna lists

Fauna observations

Fauna species recorded during the biannual monitoring surveys from spring 2011 to autumn 2015, either through opportunistic observations or targeted survey are outlined below.

A = autumn, B = spring.

Common Name	Latin Name	2011	2012A	2012B	2013A	2013B	2014A	2014B	2015A	2015B
Australasian Grebe	*Tachybaptus novaehollandiae*		x		x	x	x		x	
Australian Magpie	*Gymnorhina tibicen*	x	x	x	x	x	x	x	x	x
Australian Raven	*Corvus coronoides*	x	x	x	x	x	x	x	x	
Australian Wood Duck	*Chenonetta jubata*			x	x	x			x	x
Australian King Parrot	*Alisterus scapularis*								x	
Black-faced Cuckoo-Shrike	*Coracina novaehollandiae*		x	x		x		x		x
Brown Falcon	*Falco berigora*					x		x	x	
Common Bronzewing	*Phaps chalcoptera*	x			x		x			
Common Starling	*Sturnus vulgaris*									x
Crested Pigeon	*Ocyphaps lophotes*				x	x	x		x	
Diamond Firetail	*Stagonopleura guttata*	x			x					
Double Barred Finch	*Taeniopygia bichenovii*				x					
European Goldfinch	*Carduelis carduelis*				x					x
Fan-tailed Cuckoo	*Cacomantis flabelliformis*					x		x		x
Galah	*Eolophus roseicapillus*	x		x		x		x	x	x
Grey Butcherbird	*Cracticus torquatus*		x	x					x	x
Grey Currawong	*Strepera versicolor*									x
Grey Fantail	*Rhipidura albiscapa*	x	x	x		x	x	x	x	x
Grey Shrike-Thrush	*Colluricincla harmonica*		x		x	x	x	x	x	
Hard Head	*Aythya australis*			x	x					
Honeyeater, White-Eared	*Lichenostomus penicillatus*	x	x		x				x	

Common Name	Latin Name	2011	2012A	2012B	2013A	2013B	2014A	2014B	2015A	2015B
Honeyeater, White-Plumed	*Lichenostomus penicillatus*				x	x				
Honeyeater, Yellow Faced	*Lichenostomus chrysops*			x				x	x	x
Honeyeater, White naped	*Melithreptus lunatus*								x	
Horsfield's Bronze Cuckoo	*Chrysococcyx basalis*							x		
Jacky Winter	*Microeca fascinans*	x		x		x				x
Kookaburra	*Dacelo novaeguineae*	x		x					x	x
Leaden Flycatcher	*Myiagra rubecula*			x						
Magpie Lark	*Grallina cyanoleuca*	x	x	x	x	x	x	x	x	x
Masked Lapwing	*Vanellus miles*					x		x		
Nankeen Kestral	*Falco cenchroides*					x		x		
Noisy Friarbird	*Philemon corniculatus*			x		x		x		x
Noisy Miner	*Manorina melanocephala*	x	x	x	x	x	x	x	x	x
Pacific Black Duck	*Anas superciliosa*			x	x	x		x	x	
Pardalote, Spotted	*Pardalotus punctatus*	x	x	x	x		x	x	x	x
Pardalote, Striated	*Pardalotus striatus*	x		x	x	x	x	x	x	x
Pallid Cuckoo	Cuculus pallidus									x
Pied Butcherbird	*Cracticus nigrogularis*							x		x
Pied Currawong	*Strepera graculina*	x	x	x	x	x	x	x	x	x
Quail	*Coturnix sp.*	x				x				
Red-Browed Finch	*Neochmia temporalis*			x	x	x		x		
Red Wattlebird	*Anthochaera carunculata*					x		x	x	x
Robin, Eastern Yellow	*Eopsaltria australis*						x			x
Robin, Flame	*Petroica phoenicea*	x					x			
Robin, Hooded	*Melanodryas cucullata cucullata*	x								x
Robin, Scarlet	*Petroica boodang*		x		x		x		x	
Rosella, Crimson	*Platycercus elegans*	x	x	x	x	x	x	x	x	x
Rosella, Eastern	*Platycercus adscitus*	x	x	x	x	x		x	x	x
Red Rumped Parrot	*Psephotus haematonotus*								x	
Sacred Kingfisher	*Todiramphus sanctus*			x						

Common Name	Latin Name	2011	2012A	2012B	2013A	2013B	2014A	2014B	2015A	2015B
Shining Bronze Cuckoo	*Chrysococcyx lucidus*							x		
Silvereye	*Zosterops lateralis*								x	
Southern White-face	*Aphelocephala leucopsis*						x			
Speckled Warbler	*Chthonicola sagittatus*				x		x			
Sulphur-Crested Cockatoo	*Cacatua galerita*	x				x	x	x		x
Superb Fairy Wren	*Malurus cyaneus*	x	x	x	x	x	x	x	x	x
Thornbill, Brown	*Acanthiza pusilla*	x		x	x	x		x	x	
Thornbill, Yellow-Rumped	*Acanthiza chrysorrhoa*	x	x	x	x	x	x	x	x	x
Thornbill, Yellow	*Acanthiza nana*								x	
Tree Martin	*Petrochelidon nigricans*					x				
Wedge-Tailed Eagle	*Aquila audax*	x	x		x		x		x	
Weebill	*Smicrornis brevirostris*				x			x	x	x
Welcome Swallow	*Hirundo neoxena*								x	
Whistler, Golden	*Pachycephala pectoralis*	x	x			x				
Whistler, Rufous	*Pachycephala rufiventris*			x	x	x		x		x
White-bellied Sea-Eagle	*Haliaeetus leucogaster*					x				
White faced Heron	*Egretta novaehollandiae*								x	x
White Throated Tree Creeper	*Cormobates leucophaeus*	x	x	x	x	x	x	x	x	
White-fronted Gerygone	*Gerygone olivacea*			x		x		x		x
White-winged Chough	*Corcorax melanorhamphos*		x	x		x		x	x	x
White-winged Triller	*Lalage sueurii*							x		
Willie Wagtail	*Rhipidura leucophrys*	x	x		x	x		x	x	x
Yellow Tailed Black Cockatoo	*Calyptorhynchus funereus*				x					

Mammals	Latin Name	2011	2012A	2012B	2013A	2013B	2014A	2014B	2015A	2015B
Brushtail Possum	*Trichosurus vulpecula*					x	x	x		x
Cow	*Bos Taurus*	x					x		x	x
European Rabbit	*Oryctolagus cuniculus*	x	x	x	x	x	x	x		x
Feral Goat	*Capra aegagrus hircus*		x	x	x	x	x		x	x
Feral Pig	*Sus scrofa*		x			x	x		x	
Fox	*Vulpes vulpes*	x	x	x	x	x	x	x	x	x
Kangaroo	*Macropus giganteus*	x	x	x	x	x	x	x	x	x
Sheep	*Ovis aries*				x	x				
Sugar Glider*	*Petaurus breviceps*					x	x			
Swamp Wallaby	*Wallabia bicolor*					x	x	x		
Wallaroo, Common	*Macropus robustus*							x	x	
Wombat	*Vombatus ursinus*	x	x	x	x	x	x	x	x	x

Other	Latin Name	2011	2012A	2012B	2013A	2013B	2014A	2014B	2015A	2015B
Delicate skink	*Lamphrolis delicata*							x		
Eastern Bearded Dragon	*Pogona barbata*			x						
Eastern Common Froglet	*Crinia signifera*		x	x	x	x	x	x	x	x
Eastern Long-necked Tortoise	*Chelodina longicollis*		x		x	x	x		x	x
Eastern Water Dragon	*Intellagama lesueurii*									
Echidna	*Tachyglossus aculeatus*					x			x	x
Jacky Lizard	*Amphibolurus muricatus*	x							x	x
Peron's Tree Frog	*Litoria peronii*					x		x		
Plains Froglet	*Crinia parainsignifera*			x	x	x	x	x	x	
Red Bellied Black Snake	*Pseudechis porphyriacus*							x		
Smooth Toadlet	*Uperolia laevigata*					x		x	x	
Spotted Marsh Frog	*Limnodynastes tasmaniensis*			x	x	x	x	x	x	x
Whistling Tree Frog	*Litoria verreauxii*			x		x		x		

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