M2G Offset Property Monitoring Report

Autumn 2013

Prepared for
ACTEW Water

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Contents

List of figures

List of tables

Abbreviations

ABBREVIATION	DESCRIPTION
BWA	Bulk Water Alliance
CEMP	Construction Environmental Management Plan
DoP	NSW Department of Planning
DPI	NSW Department of Primary Industries
EMSP	Environmental Management Sub-Plan
EPA	Environment Protection Authority
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)
LMA	Land Management Agreement
LRMP	Landscape Rehabilitation Management Plan
M2G	Murrumbidgee to Googong Water Transfer Project
ODP	Offset Delivery Plan
OEMP	Operation Environmental Management Plan
ORMP	Offset Rehabilitation Management Plan
TEMP	Terrestrial Ecology Management Plan

Executive summary

The Biodiversity Offset site provided to compensate for impacts resulting from the development of the Murrumbidgee to Googong Water Transfer Project (M2G) was surveyed in autumn 2013 as part of a twice-yearly monitoring program implemented to inform the management of the offset. The autumn 2013 surveys found that the offset site is in good condition and is responding well to the management actions implemented to date, particularly exclusion of stock and weed control works. Evidence for this is the abundant natural regeneration of *Eucalyptus* spp. and other species such as *Dodonaea viscosa* across the offset site. The primary weed control activities undertaken have been successful and thorough. Secondary control and follow up targeted control measures are expected to further reduce the abundance and distribution of the key weed species. Feral animals continue to be an issue that requires ongoing monitoring and an adaptive management approach is required to ensure that they do not impact substantially on the condition of the site.

At this stage, only minor additional works are recommended other than those already scheduled under the Offset Delivery Plan. These include removal of internal fencing and fencing of MU7, both of which are currently in the process of being implemented. Other minor recommended works include secondary/follow-up control of African Love Grass in small areas missed during the primary control program.

Further monitoring in spring 2013 will guide whether additional management actions are required in late 2013.

1 Introduction

1.1 Background

Eco Logical Australia Pty Ltd (ELA) was commissioned by ACTEW Water (ACTEW) 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 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 has been attained from all three governments, with a considerable number of approval conditions and commitments applied.

Under the environmental approvals process, ACTEW was required to provide compensatory habitat as an offset to compensate for vegetation and habitat losses arising from the construction activities associated with 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.l of the Commonwealth approval conditions for the M2G Project (see Offset Delivery Plan for further information), management and monitoring of the offset site is required. The Offset Delivery Plan (ODP) prepared by ELA (April 2012) describes the actions to be taken in establishing and managing the offset site under the approval conditions and commitments including the provision of monitoring actions (Eco Logical Australia 2012).

This report details the autumn monitoring surveys for 2013 that were undertaken in accordance with the methodology and aims established in the ODP. It is designed to be a standalone monitoring report mimicking the format of the previous biannual monitoring reports, but also to be read in context with the ODP. The purpose of this document is to report on the ecological condition of the site and management actions conducted within the previous year, to guide future actions within the offset site.

The *Autumn 2013 Monitoring Report* incorporates the results of the field surveys and where applicable, provides a comparison against previous biannual monitoring surveys.

1.3 Study Area

ACTEW own a land parcel in the southern ACT (Block 1675), referred to here as the Williamsdale property (or 'the property'). The property is located just south of Williamsdale and 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 Box-Gum Woodland, threatened flora and fauna species and/or threatened species habitat.

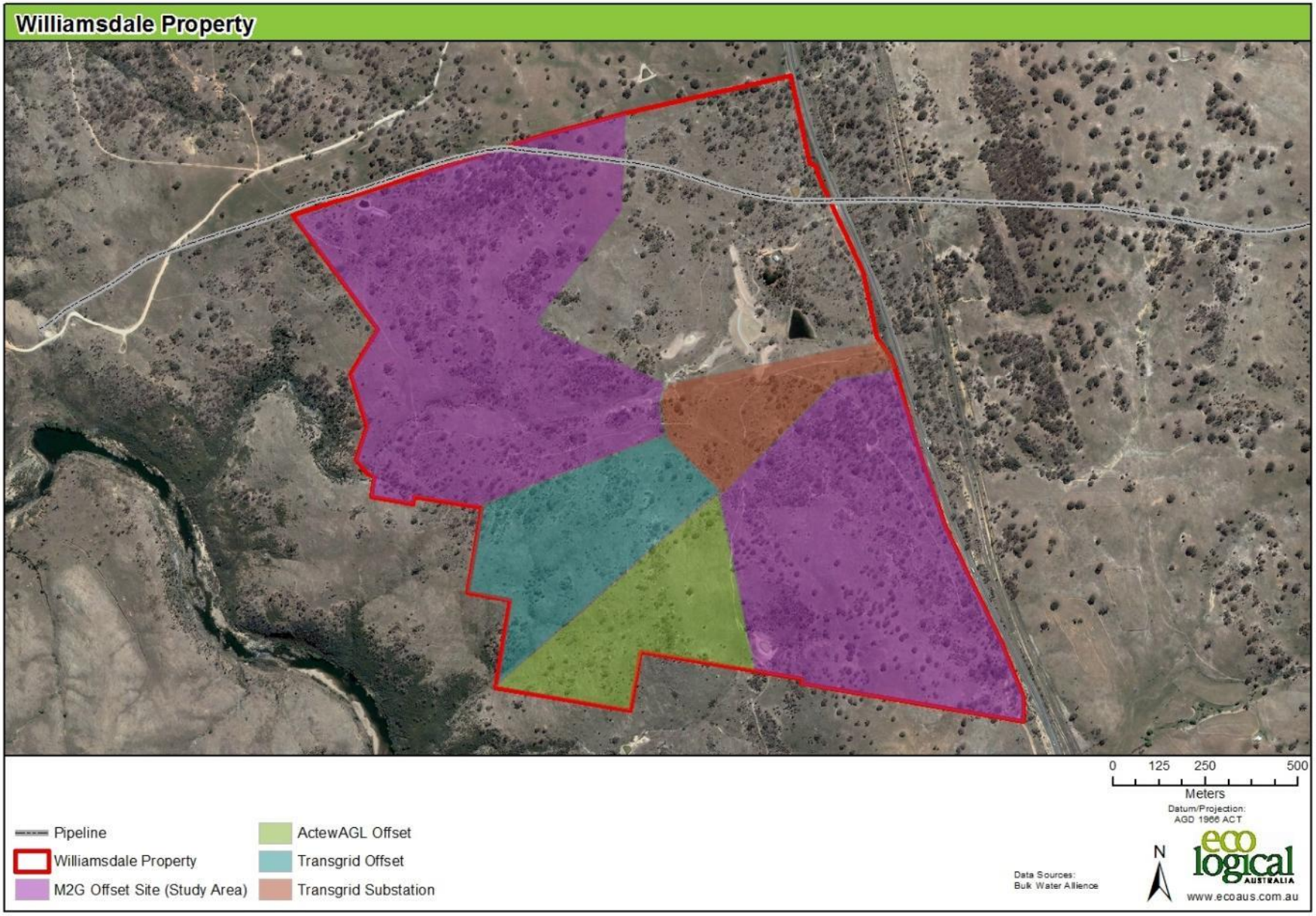


Figure 1: Study area

2 Field survey methods

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 autumn 2013 monitoring surveys.

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 transects 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 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 2m 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 at the time of establishment were free from noxious weeds. Where possible, no management actions, such as weed control, erosion control, or rehabilitation are planned to 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. 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 areas where management actions were planned or likely to occur as outlined in the management sub-plans, in order to observe the effect that management actions have on ecological values and species composition.

A description of the monitoring plots is provided in **Figures 4-10**. 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 plots

2.1.2 Step 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 projected foliage cover and structural components of the community. Each transect was referenced using a GPS device and 3 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) as either native grass, native shrub, native other or exotic species. The understory cover was then presented as a percentage cover of each vegetation type (native or exotic).
- At every 5 m along the 50 m tape, the foliage cover of the native and exotic species in the mid and overstorey layer was recorded (10 survey points per transect). The foliage cover was then recorded as a percentage for each layer.

2.2 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 is undertaken in autumn and spring using a random meander method, to fully cover the area within each MU. A GPS record is taken when a noxious weed species is observed in a patch containing multiple individuals.

2.3 Erosion monitoring methodology

Erosion monitoring sites were established during the autumn monitoring surveys. Meandering traverses were conducted across the offset site, with particular attention paid to ephemeral drainage lines and higher erosion risk areas. Points of erosion encountered were described in terms of size and their location recorded using a GPS. A photo (**Section 5**) was taken of each point in order to observe any changes over time.

It's important to note that not all points of erosion originally observed were established as a monitoring point, but rather a representative sample of all erosion points encompassing each of the drainage lines was selected. Erosion point locations are mapped in

Figure 14 & **Figure 15**.

2.4 Feral animal and fauna monitoring methodology

Feral animal monitoring has been undertaken using random meander survey techniques and opportunistic observations while undertaking monitoring surveys for other sub-plans outlined in the ODP. Opportunistic observations included details of feral animal disturbance, tracks or scats.

In addition, the use of infra-red cameras was recommended as a monitoring method in the *Autumn 2012 Monitoring Report* (ELA 2012). Remote cameras have been used with success in the United States in detecting the presence of Feral Pigs, estimating abundance, and determining trapping success (Hamrick et al., 2011).

2.4.1 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 (**Appendix B**). Locations of conservation significant fauna and signs of feral animal presence were referenced using a GPS device.

2.4.2 Infra-red camera surveys

Two infra-red camera surveys were set-up within the offset site and left for five days, one within the northern offset and the other in the southern offset. The locations of the infra-red cameras were chosen based on fauna signs, access to water and fauna tracks, such as pig-rooting and wombat tracks / game trail.

The locations of the infra-red cameras are shown in **Figure 3**.

2.5 Fencing monitoring methodology

Fence monitoring was undertaken by traversing the Williamsdale property border fence line and assessing the condition of the fence. Any areas observed along the fence line that required attention were noted and a GPS point taken.

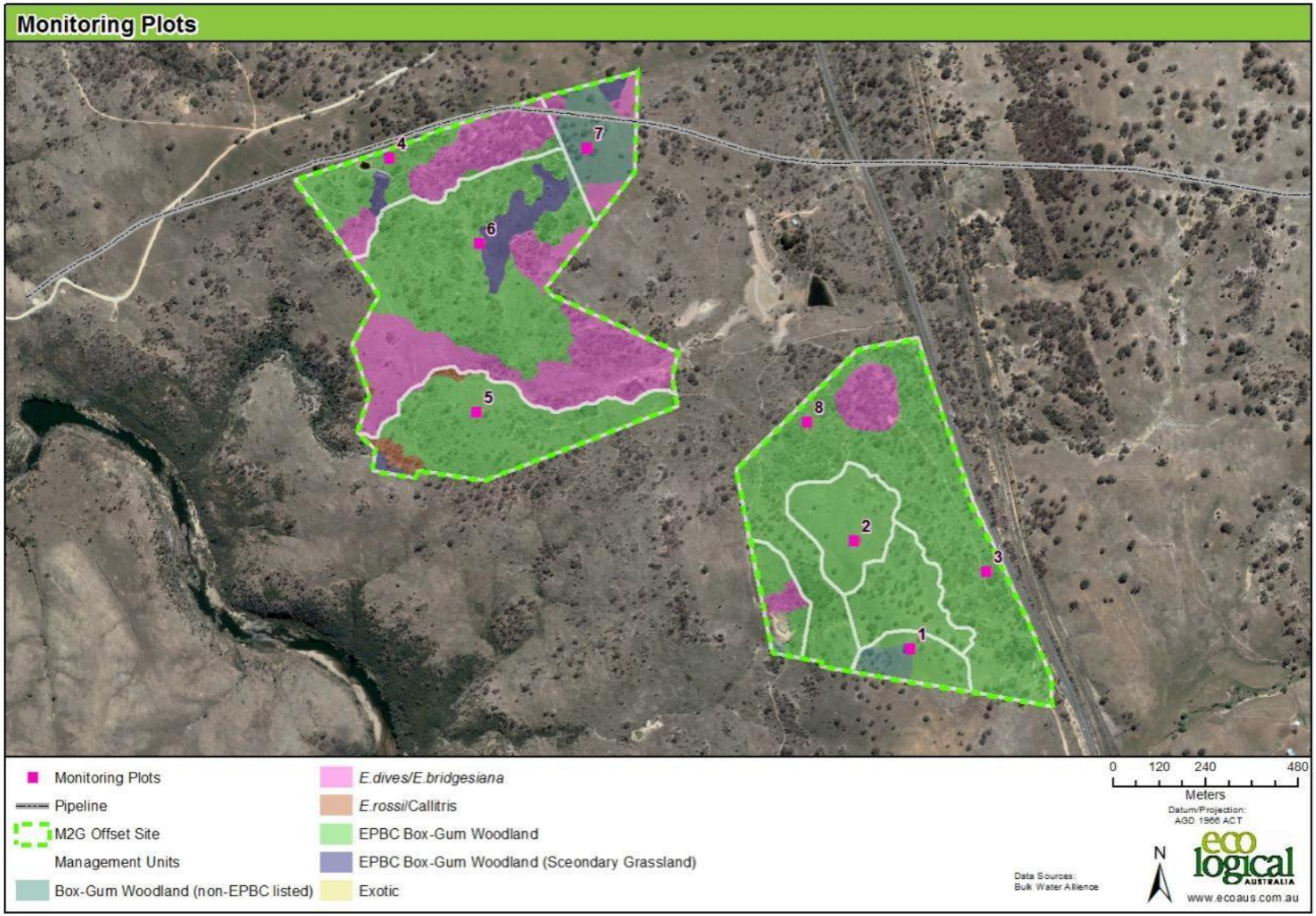


Figure 2: Monitoring plots and baseline offset site ecological values

Figure 3: Management Units and monitoring plot and infra-red camera locations

3 Monitoring plot results

3.1 Primary on ground works

A number of primary on-ground works were undertaken throughout 2012 and include:

- Erection of new Williamsdale property southern boundary fence (July 2012)
- Feral Pig control (September 2012)
- Weed Control for African Lovegrass and Serrated Tussock (July 2012)
- Weed Control for other weed species (late 2012-2013)
- Autumn & Spring 2012 monitoring surveys

3.2 Overview of monitoring results

The conditions leading up to the monitoring period in May 2013 were unusually dry and a comparison of meteorological data (Bureau of Meteorology, 2013) showed that there was approximately 72mm less rainfall (~34% reduction) in the 1st quarter 2013 (January to March) than over the same period of the long term average.

The monitoring surveys confirmed that the site has not received substantial rainfall in some time. Previous surveys recorded water in most of the ephemeral drainage lines within the offset site; however, the autumn 2013 surveys only recorded water in the two permanent dams and a small amount of water in the main drainage line.

In general, the condition of the offset site is good despite the lack of recent rain. Weed control undertaken in 2012 appears successful in most areas, and the removal of stock from the offset site appears to have had a significant effect on the amount of shrub regeneration occurring. Large numbers of young Eucalypts were recorded sprouting across the offset site as well as good numbers of *Dodonaea viscosa* (and other species), which appear to be sprouting from the soil seed bank as most seedlings are not in the vicinity of mature individuals.

The monitoring surveys did not record the presence of or evidence of feral pigs within the offset site. A single set of tracks belonging to feral Goats were recorded at the northern dam, as well as scattered evidence that they may still be utilising the site. The Goats were not observed during the surveys.

3.3 Vegetation monitoring plot results

The results of the vegetation monitoring are provided in the following pages. A summary of each plot is provided in **Figure 4** to **Figure 11**. Floristic results from each plot are provided in **Appendix A**.

3.3.1 Monitoring Plot 1

Plot Description			
Management Unit	MU1	*Plot Number*	1
Vegetation Type	Box-Gum Woodland	*Condition*	Low-mod
Plot Statistics			
Native Overstorey Cover (%)	0	Regeneration	Yes
Native Mid-Story Cover (%)	0	Species	*E. blakelyi*
Native Understory Cover (grass) (%)	70		
Native Understory Cover (Shrub) (%)	0		
Native Understory Cover (Other) (%)	2		
Exotic Midstorey plant cover (%)	0		
Exotic Understory plant cover (%)	18		
Native Species diversity	10		

Monitoring plot 1 is located within MU1 on the southern offset. The monitoring plot is composed of relatively lower condition Box-Gum Woodland. Natural regeneration of the overstorey was present with a low number of saplings observed within the monitoring plot. This is in comparison to no regeneration recorded during the baseline surveys. Native species diversity was low (10 species) which is probably a reflection of the time of year as well as the climatic conditions experienced over the previous months. Despite low native diversity, the plot was still dominated by native species. The dominant species included *Austrostipa* spp., *Microlaena stipoides* (Weeping Grass) and *Carex inversa* (Common Sedge). It was noted that several Serrated Tussock (*Nassella trichotoma*) individuals sprouted following weed control works within and adjacent to the plot.

Figure 4: Monitoring Plot 1. (Left: Baseline monitoring photo, March 2012. Right: Monitoring photo May 2013)

3.3.2 Monitoring Plot 2

Plot Description			
Management Unit	MU2B	*Plot Number*	2
Vegetation Type	Box-Gum woodland	*Condition*	Mod-Good
Plot Statistics			
Native Overstorey Cover (%)	0.5	Regeneration	Yes
Native Mid-Story Cover (%)	0	Species	*E. blakelyi*
Native Understory Cover (grass) (%)	84		
Native Understory Cover (Shrub) (%)	0		
Native Understory Cover (Other) (%)	4		
Exotic Midstorey plant cover (%)	0		
Exotic Understory plant cover (%)	12		
Native Species diversity	31		

Monitoring plot 2 is located within MU2 within the southern offset. It is situated on a rocky hill containing Pink-tailed Worm Lizard habitat. It contains relatively good condition mature Box-Gum Woodland with limited regeneration present. It contains a moderate to high diversity of native understorey species and is generally devoid of exotic grasses. The groundlayer is dominated by *Austrodanthonia* spp., *Austrostipa* spp. and *Chrysocephalum apiculatum* (common everlasting). The autumn 2013 monitoring surveys recorded 31 native species.

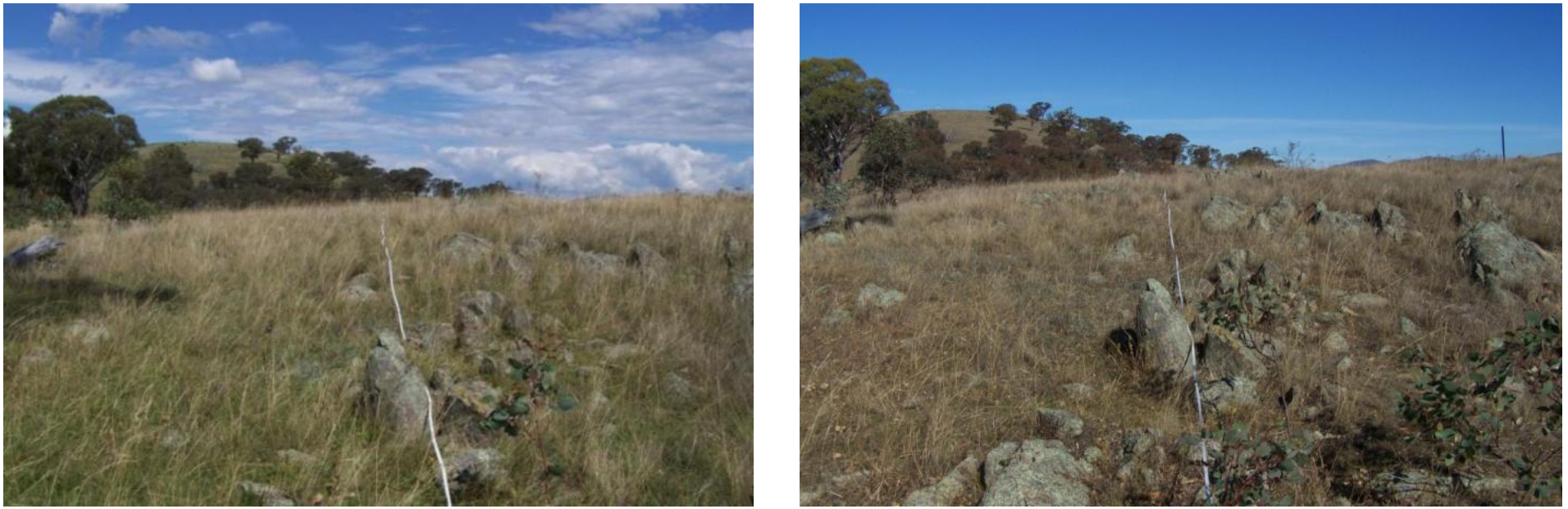


Figure 5: Monitoring Plot 2. (Left: Baseline monitoring photo, March 2012. Right: Monitoring photo May 2013)

3.3.3 Monitoring Plot 3

Plot Description			
Management Unit	MU3	*Plot Number*	3
Vegetation Type	Box-Gum Woodland	*Condition*	Mod-Good
Plot Statistics			
Native Overstorey Cover (%)	1.2	Regeneration	Yes
Native Mid-Story Cover (%)	5.1	Species	*E. blakelyi*
Native Understory Cover (grass) (%)	70		
Native Understory Cover (Shrub) (%)	4		
Native Understory Cover (Other) (%)	6		
Exotic Midstorey plant cover (%)	0		
Exotic Understory plant cover (%)	6		
Native Species diversity	30		

Monitoring plot 3 is located within MU3. The plot is located in moderate to good quality Box-Gum Woodland. The plot is dominated by mature *E. blakelyi* and a significant amount of natural regeneration is present. A diverse understorey exists with dominant species including *Themeda australis* (Kangaroo Grass), *Austrodanthonia* spp. (Wallaby Grasses) and *Bothriochloa macra* (Red-leg Grass). The understorey has a high diversity of native species (30) which is an increase compared to the baseline monitoring diversity (26). Seasonal variation in the understorey can be seen in the photos below. Weed control activities undertaken in 2012 targeted Sweet Briar and appear to have been successful at this stage.

Figure 6: Monitoring Plot 3. (Left: Baseline monitoring photo, March 2012. Right: Monitoring photo May 2013)

3.3.4 Monitoring Plot 4

Plot Description			
Management Unit	MU4	*Plot Number*	4
Vegetation Type	Box-Gum Woodland	*Condition*	Mod-Good
Plot Statistics			
Native Overstorey Cover (%)	5.5	Regeneration	Yes
Native Mid-Story Cover (%)	2	Species	*E. blakelyi*
Native Understory Cover (grass) (%)	78		
Native Understory Cover (Shrub) (%)	4		
Native Understory Cover (Other) (%)	8		
Exotic Midstorey plant cover (%)	0		
Exotic Understory plant cover (%)	6		
Native Species diversity	34		

Monitoring plot 4 is located in the northern offset in MU4. The plot is located in moderate to good quality Box-Gum Woodland dominated by *E. blakelyi*. The plot supports a highly diverse understorey composed of 34 native species compared to 26 recorded in the baseline surveys. The dominant species are *Themeda australis*, *Schoenus apogon* and *Haloragis heterophylla*. The woody weed, *R. rubiginosa* comprise the majority of the mid-storey and was targeted in the weed control activities undertaken in 2012. At the time of monitoring, control appeared successful. A moderate to strong level of regeneration exists within the MU with a qualitative assessment indicating an increase in regeneration (*Eucalyptus* spp., *Dodonaea viscosa*) compared to the baseline monitoring (prior to grazing exclusion).

Figure 7: Monitoring Plot 1. (Left: Baseline monitoring photo, March 2012. Right: Monitoring photo May 2013)

3.3.5 Monitoring Plot 5

Plot Description			
Management Unit	MU5	*Plot Number*	5
Vegetation Type	Box-Gum woodland	*Condition*	Mod-Good
Plot Statistics			
Native Overstorey Cover (%)	0	Regeneration	Yes
Native Mid-Story Cover (%)	14.2	Species	*E. blakelyi*
Native Understory Cover (grass) (%)	76		
Native Understory Cover (Shrub) (%)	4		
Native Understory Cover (Other) (%)	6		
Exotic Midstorey plant cover (%)	0		
Exotic Understory plant cover (%)	14		
Native Species diversity	27		

Monitoring plot 5 is a control plot located in MU5. No management actions will occur within the bounds of the monitoring plot. Plot 5 is located in moderate-good quality Box-Gum Woodland dominated by *E. blakelyi* with a significant amount of natural regeneration present. The monitoring plot supports a highly diverse understorey of grasses, herbs and forbs with 60 native species recorded in spring 2012. However, only 27 species were recorded in autumn 2013. This is likely a result of natural seasonal variation as well as the lower rainfall recorded in the first quarter of 2013. The understorey is known to support a high diversity of forbs including typically grazing intolerant species, such as *Swainsona sericea, Microseris lanceolata*, *Arthropodium minus* and *Microtis unifolia* (recorded spring 2012).

Figure 8: Monitoring Plot 1. (Left: Baseline monitoring photo, March 2012. Right: Monitoring photo May 2013)

3.3.6 Monitoring Plot 6

Plot Description			
Management Unit *Vegetation Type*	MU6 Box-Gum Woodland	*Plot Number* *Condition*	6 Mod-Good
Plot Statistics			
Native Overstorey Cover (%)	3	Regeneration	yes
Native Mid-Story Cover (%)	5.2	Species	*E. blakelyi*
Native Understory Cover (grass) (%)	78		
Native Understory Cover (Shrub) (%)	0		
Native Understory Cover (Other) (%)	10		
Exotic Midstorey plant cover (%)	14		
Exotic Understory plant cover (%)	6		
Native Species diversity	21		

Monitoring plot 6 is located in MU6 along the central ridge line, in moderate-good quality Box-Gum Woodland dominated by *E. blakelyi.* The plot supports a diverse under storey of grasses, herbs and forbs with 45 native species recorded in spring 2012. However, only 21 native species were recorded in autumn 2013, which is likely to reflect natural seasonal variation as well as climatic conditions. The understorey was dominated by native perennial tussock grasses including *Austrostipa* spp. Sweet Briar (*R. rubiginosa*) was present at low abundance in the plot and observed more broadly in the MU, however, weed control undertaken in 2012 appears to have been moderately successful in controlling this species.

Figure 9: Monitoring Plot 1. (Left: Baseline monitoring photo, March 2012. Right: Monitoring photo May 2013)

3.3.7 Monitoring Plot 7

Plot Description			
Management Unit	MU7	*Plot Number*	7
Vegetation Type	Box-Gum woodland	*Condition*	low
Plot Statistics			
Native Overstorey Cover (%)	0	Regeneration	No
Native Mid-Story Cover (%)	0	Species	*N/A*
Native Understory Cover (grass) (%)	74		
Native Understory Cover (Shrub) (%)	0		
Native Understory Cover (Other) (%)	20		
Exotic Midstorey plant cover (%)	0		
Exotic Understory plant cover (%)	20		
Native Species diversity	10		

Monitoring plot 7 is located within MU7 in the northern offset. The MU is composed of degraded Box-Gum Woodland dominated by *E. blakelyi*. However, no native overstorey or mid-storey was recorded within the plot. Native species diversity was low (10 species) in comparison with other monitoring plots with little change compared to the baseline surveys (13 native species). The plot is dominated by native species (predominantly sedges and rushes); however, evidence of the significant exotic annual cover recorded in spring 2012 still occurs on site. Sheep were observed grazing within MU7 over the monitoring period and have had a considerable impact on the vegetation within the management unit.

Figure 10: Monitoring Plot 1. (Left: Baseline monitoring photo, March 2012. Right: Monitoring photo May 2013)

3.3.8 Monitoring Plot 8

Plot Description			
Management Unit	MU3B	*Plot Number*	8
Vegetation Type	Box-Gum Woodland	*Condition*	Mod-Good
Plot Statistics			
Native Overstorey Cover (%)	0	Regeneration	Yes
Native Mid-Story Cover (%)	6.5	Species	*E. blakelyi*
Native Understory Cover (grass) (%)	78		
Native Understory Cover (Shrub) (%)	4		
Native Understory Cover (Other) (%)	8		
Exotic Midstorey plant cover (%)	0		
Exotic Understory plant cover (%)	2		
Native Species diversity	26		

Monitoring plot 8 (3b) 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.* The plot supports a diverse understorey of grasses, herbs and forbs with 41 native species recorded in spring 2012. Of those, 26 native species were recorded in autumn 2013, which is likely to reflect natural seasonal variation as well as climatic conditions. The dominant understorey species included *Themeda australis*, *Austrodanthonia* spp. and *Chrysocephalum apiculatum*. Photo comparison shows a healthy understorey dominated by native species with good inter-tussock spacing.

Figure 11: Monitoring Plot 1. (Left: Baseline monitoring photo, March 2012. Right: Monitoring photo May 2013)

4 Weed monitoring

4.1 Weed management actions undertaken to date

Weed management activities on site have included control of *Eragrostis curvula* (African Lovegrass) and *Nassella trichotoma* (Serrated Tussock) in mid-2012 as well as woody weed control undertaken later in 2012-2013.

For further detail on the management actions recommended refer to the ODP and associated sub-plans.

4.2 Weed monitoring results

A summary of the weed occurrences across the offset site and the 2012 spring monitoring results is provided in **Table 2** below.

The relative distribution of key weed species across the offset site has been mapped in **Figure 12** and **Figure 13**.

Table 2: Summary of weed occurrence across the offset site and 2013 autumn monitoring results

Species	Weed occurrence prior to surveys*	Autumn 2013 monitoring results**
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.	A number of isolated individuals observed across the offset site with some heavier infestations around main drainage line. Most areas across the site exhibited a good level of control for this species. **MU occurrence**: MU3, 4, 5 & 6. **Recommendation**: Follow-up weed control to target drainage lines for the few patches not sprayed in 2012.
Serrated Tussock (*Nassella trichotoma*)	Low, scattered individuals in some areas. Present in the more open areas of the offset site. The species was primarily present as a number of scattered individuals within MU1 along the southern boundary.	Control for this species was successful with only a few scattered individuals observed within the southern offset (MU1) reappearing. **MU occurrence**: MU1A, 2A, 3 & 4 **Recommendation**: Maintain weed control program as outlined in the sub-plan.

Species	Weed occurrence prior to surveys*	Autumn 2013 monitoring results**
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 of the site.	Primary control for this species occurred in late 2012-2013. Control for this species looks moderately successful; however, regrowth is present in some areas. **MU occurrence**: MU3, 4, 5 & 6. **Recommendation**: Secondary control including spot spraying of re-sprouting individuals.
Hawthorn (*Crataegus monogyna*)	Very low, isolated individuals. Present within the study area as isolated individuals.	Control for this species occurred in late 2012-2013. Control for this species looks moderately successful. Some individuals were not sprayed this season. **MU occurrence**: MU4 & 6. **Recommendation**: Follow up spot spraying of individuals.
St John's Wort (*Hypericum perforatum*)	Scattered and moderate occurrence across the offset site.	Control for this species occurred in late 2012-2013. Species was not in flowering during the monitoring surveys, however, control looks moderately successful. **MU occurrence**: MU1A, 1B, 2A, 3, 4, 5, 6 & 7. **Recommendation**: Follow up secondary control.
Thistle (*Onopordum* sp.)	Low, localised areas of dominance. Higher proportion present at both dams.	Consider targeted control as part of any future weed spraying. **MU occurrence**: MU1B & 4.
Sweet Briar (*Rosa rubiginosa*)	Moderate, widely distributed at low density with scattered individuals, some areas of dominance. Present right across the offset site, often with larger infestations under mature trees.	Control for this species occurred in late 2012-2013. Control for this species looks excellent with most individuals targeted during the works. A few isolated individuals were missed and others are re-sprouting. **MU occurrence**: MU1B, 2A, 2B, 3, 4, 5, 6 & 7. **Recommendation**: Follow up secondary control including spot spraying of individuals.

4.3 Adaptive management recommendations

ELA recommends that secondary control for all weed species across the offset site. In most instances control works to date have been successful, and follow up works need only target those missed in the initial works or individuals which have re-sprouted.

No additional management actions to the weed control outlined in the weed management sub-plan have been proposed as a result of the autumn 2013 monitoring surveys. Targeted weed control programs (follow-up control) are to be implemented in 2013.

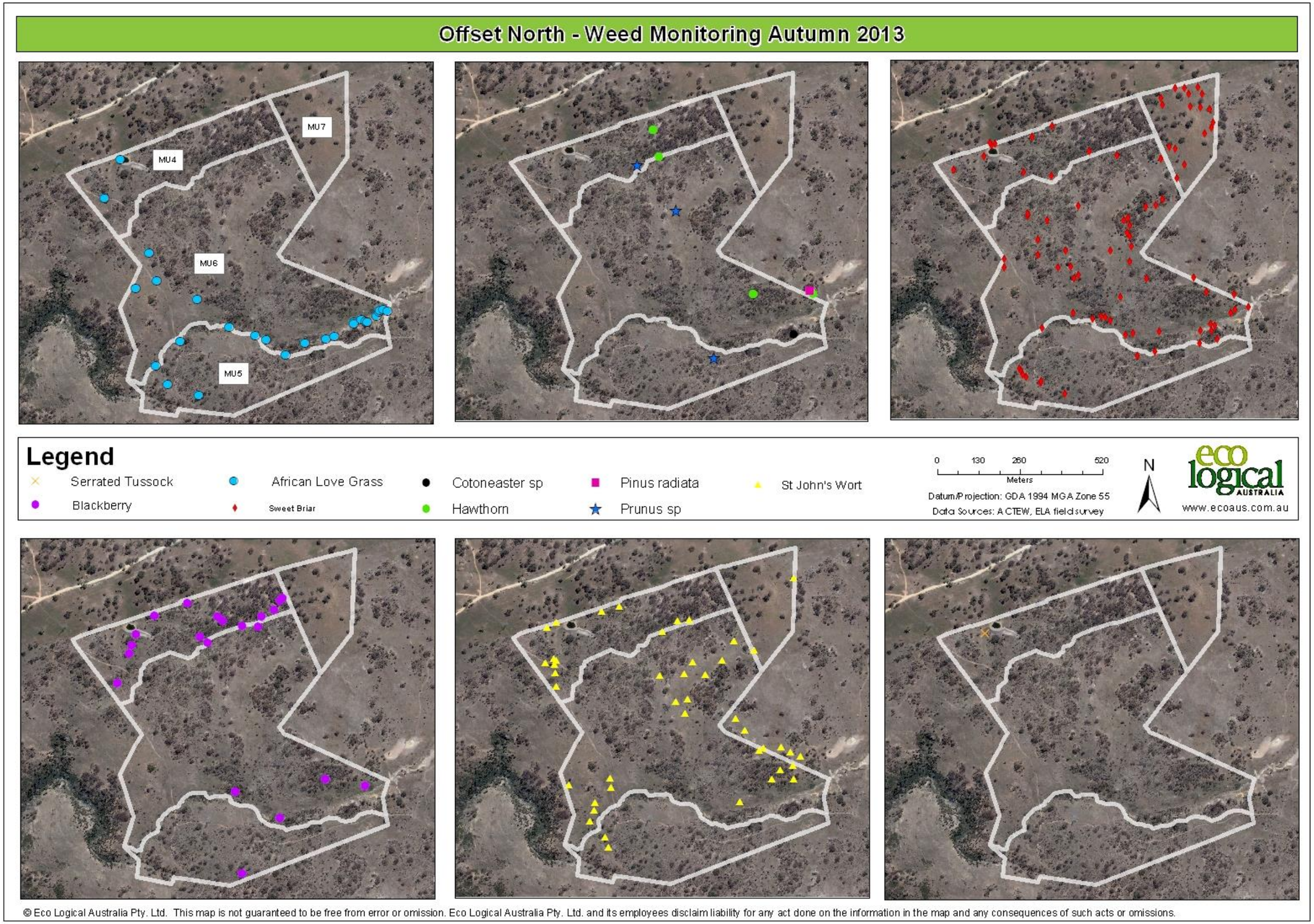


Figure 12: relative weed distribution, northern offset

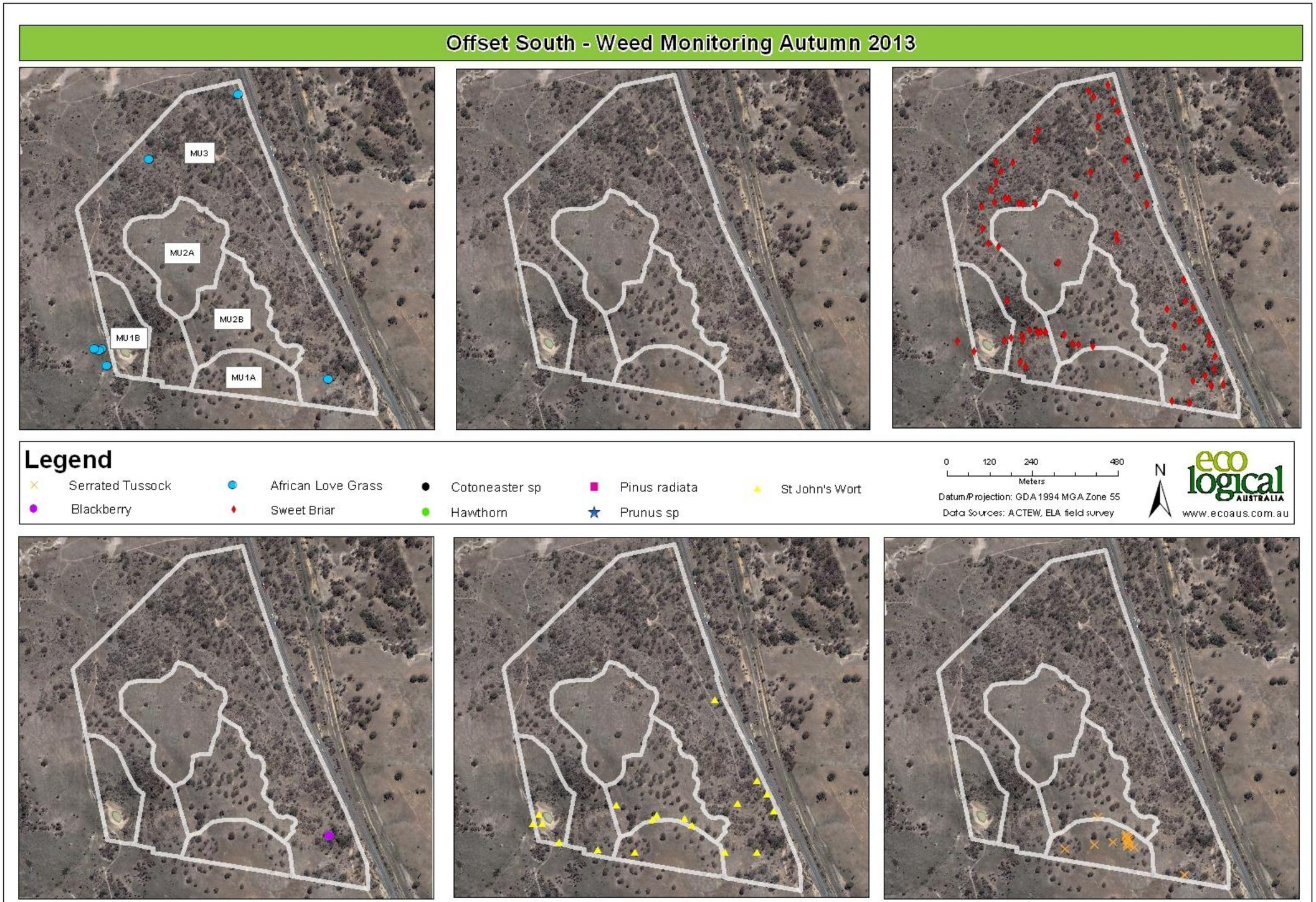


Figure 13: Relative weed distribution in the southern offset

5 Erosion monitoring

5.1 Erosion management actions undertaken to date

It should be noted that 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.

5.2 Erosion monitoring results

A total of 18 erosion points were recorded during the autumn 2012 monitoring surveys with all points falling within Erosion Management Zone 1 (see ODP). An additional three monitoring points were established in spring 2012, and one in autumn 2013. Erosion monitoring points, three and 19 were stopped for the autumn 2013 surveys. Erosion point locations are mapped in **Figure 14** and **Figure 15**.

The majority of erosion 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 high. All of the points are currently stable, but some may require minor remediation works in the future if they are found to be active following a significant rain event. 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 within the offset property is provided below followed by a more detailed description of each point and an accompanying photo.

It should be noted that the first quarter of 2013 was uncharacteristically dry and many of the erosion points which previously contained water were found to be dry. It is unlikely that significant erosion has occurred between the previous surveys and the autumn surveys. However, given that the soil moisture is currently low, high intensity rain events may cause increased erosion (cracking and slumping) at certain points if the rain events exceed soil infiltration / permeability thresholds. As such, continued monitoring is recommended following high intensity rain events.

Erosion Point 1:

Description: Small erosion point located in southern offset, MU3 situated within a small ephemeral drainage line.

Size: Approximately 1.5m across 0.3m deep and 1.5m long.

Change: No significant change observed compared to baseline monitoring.

Action required: No ground works required at this stage. Continue bi-annual monitoring.

Autumn 2012 (baseline)

Autumn 2013

Erosion Point 2:

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

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

Change: No significant change observed since baseline monitoring survey.

Action required: No works required at this stage. Continue bi-annual monitoring.

Note: Autumn 2013 monitoring photo incorporates more of the erosion point on right hand-side of the photo.

Autumn 2012

Autumn 2013

Erosion Point 3:

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

Size: Approximately 1.0m across, 0.4m deep and 1.5m long.

Change: No significant change observed since baseline monitoring survey.

Action required: No works required at this stage. Recommended to cease bi-annual monitoring.

Autumn 2012

No picture available

This erosion point has been re-assessed and is recommended to be removed from future monitoring. The site is a slow moving ephemeral drainage line where a number of other points are being used to monitoring the occurrence of erosion.

Autumn 2013

Erosion Point 4:

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

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

Change: No significant change observed since baseline monitoring survey.

Action required: No works required at this stage. Continue bi-annual monitoring.

Autumn 2012

Autumn 2013

Erosion Point 5:

Description: Located within an ephemeral drainage line within MU4, northern offset. Slight evidence of active erosion increasing the undercut.

Size: Approximately 0.3m wide, 0.5m deep and 1.5m long.

Change: Limited erosion occurring at gully head, no change since spring 2012.

Action required: No works required at this stage. Continue bi-annual monitoring.

Note: There is a difference in the scale of the 2 photos. The right photo is zoomed out to incorporate a broader picture of the erosion point.

Autumn 2012

Autumn 2013

Erosion Point 6:

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

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

Change: No significant change observed since baseline monitoring survey.

Action required: Continued bi-annual monitoring and targeted monitoring following heavy rains.

Autumn 2012

Autumn 2013

Erosion Point 7:

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

Size: Approximately 20m long and 1.0m deep.

Change: No significant change observed since baseline monitoring period.

Action required: Targeted monitoring at photo point following heavy rain and continue bi-annual monitoring.

Autumn 2012

Autumn 2013

Erosion Point 8:

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

Size: Approximately 15m long and 1.0m deep.

Change: No significant change observed since baseline monitoring survey. However, some evidence of animal crossing tracks beginning to develop which need to be monitored (red circles).

Action required: Targeted monitoring at photo point following heavy rain and continue bi-annual monitoring.

Autumn 2012

Autumn 2013

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. Minor changes were observed including slight deepening exposing smaller rocks on the left hand side of the channel. Minor slumping may have occurred on the left as well.

Action required: Continued bi-annual monitoring and targeted monitoring following heavy rains.

Autumn 2012

Autumn 2013

Erosion Point 10:

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

Size: Approximately 5.0m long, 0.5m deep.

Change: Some minor erosion has occurred adjacent to the new fence line (this is within the neighbouring property to the south of the offset site). No change since Spring 2012.

Action required: No immediate action required. Continued bi-annual monitoring and targeted monitoring following heavy rains.

Autumn 2012

Autumn 2013

Erosion Point 11

Description: Small area of erosion along an ephemeral drainage line located in offset south.

Size: Approximately 3.0m long, l.5m wide and 0.5m high.

Change: No significant erosion has occurred since the baseline monitoring period.

Action required: Continued bi-annual monitoring and targeted monitoring following heavy rains.

Autumn 2012

Autumn 2013

Erosion Point 12:

Description: Erosion point on western boundary of northern offset. Bed rock showing and in-stream vegetation

Size: Approximately 5.0m long, 0.8 - 1.0m deep (sloping).

Change: No significant erosion has occurred since the baseline monitoring period.

Action required: Continued bi-annual monitoring and targeted monitoring following heavy rains.

Autumn 2012

Autumn 2013

Erosion Point 13:

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

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

Change: Some minor slumping previously occurred. No change since spring 2012.

Action required: No immediate action required. Continue to monitor.

Autumn 2012

Autumn 2013

Erosion Point 14:

Description: Small area of erosion along an ephemeral drainage line located in offset north.

Size: Approximately 1.5m wide, 1.5m long and 0.5m deep.

Change: No significant erosion has occurred since the baseline monitoring period.

Action required: Continued bi-annual monitoring and targeted monitoring following heavy rains.

Autumn 2012

Autumn 2013

Erosion Point 15:

Description: Heavily vegetated erosion point along small ephemeral drainage line. Undercutting forming and ponding.

Size: Approximately 1m long, 1m wide, 0.5m deep

Change: No significant erosion has occurred since the baseline monitoring period.

Action required: No ground works required at this stage.

Autumn 2012

Autumn 2013

Erosion Point 16:

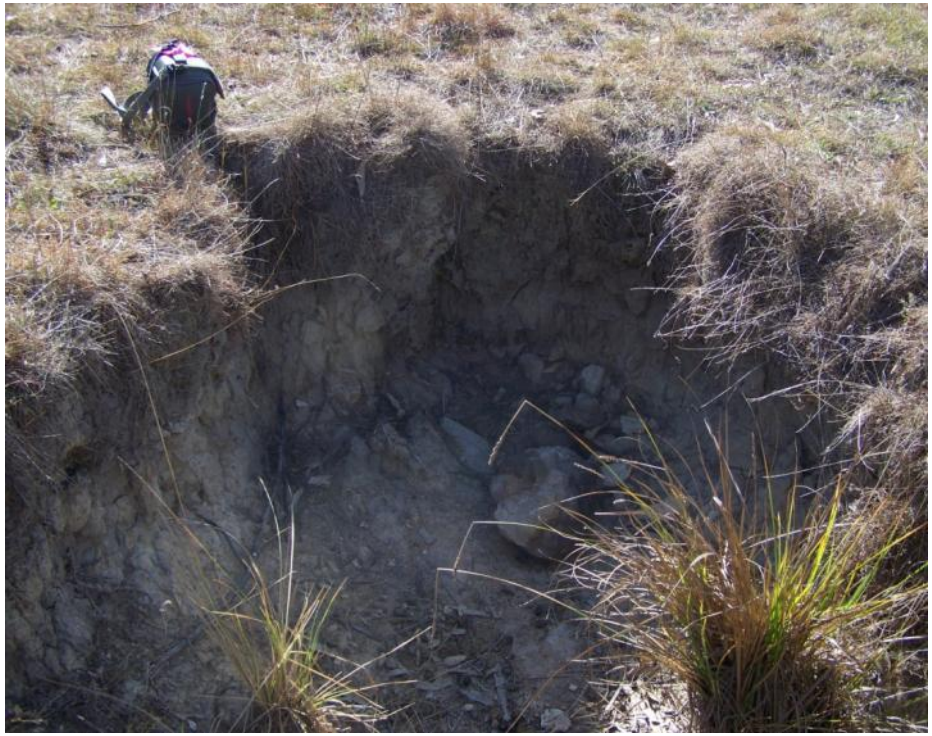
Description: Active erosion likely to be present with evidence of plunge pool formation and ponding.

Size: Approximately 3.0m long, 1.5m wide, 1.0m deep

Change: Some slight erosion is occurred at the head cut previously. No significant erosion has occurred since the previous monitoring period.

Action required: No ground works required at this stage.

Autumn 2012



Autumn 2013

Erosion Point 17:

Description: Located along an ephemeral drainage line within northern offset. Evidence of previous erosion, undercutting, pooling and in-stream vegetation.

Size: Approximately 2.5m wide, 2.5m long and 1.0m deep.

Change: No change has occurred since the previous monitoring period.

Action required: No ground works required at this stage. Continue to monitor.

Autumn 2012

Autumn 2013

Erosion Point 18:

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

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

Change: No significant erosion has occurred since the baseline monitoring period.

Action required: No ground works required at this stage.

Autumn 2012

Autumn 2013

Erosion Point 19:

Description: This erosion point has been re-assessed and is no longer considered necessary to monitor. The site is a slow moving ephemeral drainage line and is considered low risk.

	No image available
Spring 2012	Autumn 2013

Erosion Point 20:

Description: Located in the southern offset, to the east of the Dam. Base of head gully has exposed bedrock, low risk of additional erosion.

Size: 1-2m wide, 0.9m deep, 2m long

Change: No change since previous monitoring.

Action required: No action is required at this stage.

Spring 2012

Autumn 2013

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

Change: No change since previous survey.

Action required: No action is required at this stage.

Spring 2012

Autumn 2013

Figure 14: Erosion monitoring points in northern offset

Figure 15: Erosion monitoring points in southern offset

6 Feral animal monitoring

In accordance with the Feral Animal Sub-plan (see ODP) monitoring of the offset site for feral animal activity is being undertaken on a bi-annual basis to inform potential future feral animal control actions. The monitoring results for autumn 2013 are presented below.

6.1 Management actions to date

The autumn 2012 monitoring surveys identified feral pigs within the offset property. Prior to the autumn 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 at a low density across the whole of the offset.

'*Predation, habitat degradation, competition and disease transmission by feral pigs*' is listed as a key threatening process under the EPBC Act. Feral Pigs compete with native species for food and shelter resources and actively contribute to erosion and land degradation. The impact of feral pigs on threatened plants and ecological communities present within the offset site needs to be monitored and appropriately managed using adaptive management techniques.

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 recommended action, Regional Feral Animal Control (RFAC) was engaged to conduct control activities at the M2G offset site from 11th September 2012 to 3rd October 2012. The offset site was divided into three sections based on areas where pigs were frequenting. The method of control included the following procedures:

- Three free feeding stations were set up and feed provided daily until evidence of pig usage occurred.
- A central station was then established once free feeds were taken. Cameras were established to monitor numbers and to confirm feed was still being taken.
- A baited trap was then set up to capture pigs.

A total of 21 pigs were trapped and destroyed over the control period. Follow-up monitoring (17th October) conducted by RFAC two weeks following control period did not record any fresh signs of Feral Pigs.

6.2 Feral animal monitoring results – autumn 2013

Monitoring of feral animals using infra-red cameras and opportunistic observations was conducted as part of the monitoring surveys. Targeted searches were undertaken around drainage lines, permanent water sources and along animal tracks for signs (scats & tracks) of feral animal activity. The observations included:

- Feral Pigs (*Sus scrofa*): No signs of Feral Pigs were recorded across the northern or southern offset during the monitoring surveys. However, since undertaking the monitoring surveys and completing this report, signs of pig activity have been reported within and nearby the offset site.

- Feral goats (*Capra aegagrus hircus*): No feral goats were observed on site, however, a single pair of tracks was recorded at the northern dam and scattered evidence (scats) was observed in a few locations on the broader property. The species is considered likely to be utilising the site, however, the lack of good quality forage on site at the moment is likely to suggest they are currently concentrated in other areas of the Murrumbidgee River corridor.
- European Foxes (*Vulpes vulpes*): Foxes were recorded on both remote cameras within the offset site.
- European Rabbits (*Oryctolagus cuniculus*): Signs (scats and infrequently used warren) of low rabbit presence / abundance were observed.
- Hare (*Lepus capensis*): Two separate individuals were disturbed during the monitoring works. This species is predominantly solitary and is not considered a major pest, although it is noted that the species has been known to cause localised damage to plantings and native vegetation.

Since undertaking the autumn surveys, a report of pig rooting was observed at Williamsdale (outside of offset site), suggesting that pigs may be in the area.

6.3 Recommendations

Overall, the incidence of feral animals within the offset site is low compared to other survey times. It is recommended to continue monitoring as outlined in the Feral Animal Management Sub-Plan particularly in relation to the presence and abundance of Foxes, Rabbits and Goats. If evidence of an increase in any species is observed through-out the year, it is recommended that feral animal control be undertaken. This is of particular importance for Rabbits and Goats if the dry weather experienced in 2013 to date continues as these species have the ability to heavily impact on vegetation suffering from water stress.

7 Fencing monitoring

7.1 Management actions to date

Fencing of the offset site was one of the actions highlighted to be undertaken 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 (including 2 or 3 barbed wire strands) with wooden posts and/or star-pickets, approximately 1.2 m high.

In July 2012, Tennant Rural undertook works to remove the existing fence and erect a new fence along the southern boundary of the Williamsdale property (**Figure 16**). The fence was built to specifications to exclude both cattle and sheep (5 wires and 2 barbed wires). The fence was approximately 1.6km in length and included the replacement of 3 gateways.

It is understood that the removal of internal fencing within the offset property is proposed to be undertaken in June 2013. In addition, the erection of new fencing across the north-eastern section of the northern offset is proposed to be undertaken in 2013, to exclude grazing from the offset and satisfy the ACT Government Land Management Agreement (LMA).

7.2 Fencing monitoring results

The autumn 2013 fencing monitoring results has been outlined below based on the location of the boundaries:

- *Northern boundary*: The northern boundary fence is considered adequate along most of its length. However, minor maintenance is recommended in the near future for a few points where animals (e.g. wombats and kangaroos) have created a passage way, particularly if sheep will be grazing in the paddock north of the Williamsdale property. Additional fencing is to be erected around MU7. This is to exclude stock that are required to graze within the Williamsdale property as dictated in the property's ACT Land Management Agreement (LMA). It is understood that works are progressing to ensure that this is implemented. Stock is currently entering the broader offset site through the fence and gate along MU7.
- *Eastern boundary*: The eastern boundary fence adjacent to the Monaro Highway is considered adequate to exclude stock. One section along the south-eastern section where the fence crosses a drainage line requires replacing (refer to **Figure 16**)
- *Western boundary*: The western boundary fence is adequate to exclude stock. However, minor maintenance is recommended for consideration for a few points where animals (e,g, wombats, kangaroos and potentially goats) have created a passage way.
- *Southern boundary*: The southern boundary fence is adequate to exclude stock. However, minor maintenance is recommended for consideration for a few points where animals have created a passage way.

7.3 Recommendations

The overall condition of the Williamsdale property fence is good; however, additional internal fencing may be required within the property if grazing is proposed to occur on the property but outside of the

offset site in order to satisfy conditions established in the relevant Land Management Agreement. Management actions recommended to be undertaken in 2013 by ACTEW Water include:

- Fence the external border of MU7
- Repair points / sections along the boundary fence identified in **Figure 16**
- Remove internal fencing (of the offset site)

The removal of the internal fences would enhance the wildlife friendly nature of the offset site and be consistent with the biodiversity conservation ideals of the ODP and associated sub-plans.

Figure 16: Williamsdale property fence with points recommended for repair

8 Summary & recommendations

8.1 General summary

A number of primary on-ground works were undertaken throughout 2012 and include:

- Erection of new Williamsdale property southern boundary fence (July 2012)
- Feral Pig control (September 2012)
- Weed Control for African Lovegrass and Serrated Tussock (July 2012)
- Weed Control for other weed species (late 2012-2013)
- Autumn & Spring 2012 monitoring surveys.

Based on the autumn 2013 monitoring surveys, the offset site is in good condition 18 months after establishment and is responding well to management actions implemented. The main on-going works for the offset site are considered likely to be follow-up weed control to maintain suppression across the site, as well as monitoring and adaptive response to feral animal abundance.

8.1.1 Bushfire

The main access track through the offset site is currently in moderate condition. It is recommended that the access track be maintained in a condition suitable to facilitate bush fire management requirements (which it is currently). However, 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 a grassed track to limit impacts on the surrounding environment.

8.1.2 Rehabilitation works

The weed control works implemented across the site have been successful to date and could considerably reduce the abundance of woody weeds across the offset site in the short-term. Woody weeds are known to be utilised as habitat by many small woodland birds. As such, the removal through weed spraying may result in a reduction in habitat quality for these species. Depending on the observations from the spring 2013 monitoring surveys, ACTEW could consider low density scattered plantings of shrubs such as *Bursaria spinosa* to replace woody weeds removed as a result of the control program in areas where natural regeneration (of overstorey and shrub species) is relatively low; for example, in areas of management units 1A, 1B and 7 where an overstorey currently exists. Natural regeneration of mid-story and canopy species was observed over some areas of the offset site in autumn 2013, including *Bursaria spinosa, Dodonaea viscosa*, *Kunzea ericoides, Acacia* spp., *Cassinia* spp. and various Eucalypt species. These young individuals will provide habitat for the woodland birds in the long term as they spread across the site, and any plantings provided would be a complimentary measure to ensure habitat continuation in the medium term.

8.1.3 Erosion

Erosion points are generally considered to be stable and do not require active works at this stage. It is recommended to continue monitoring after heavy rainfall. Given the stability of the sites overall, it is recommend that the number of erosion monitoring points be reduced to target the larger points only and/or those considered at greatest risk. Erosion monitoring points that could initially be removed from the monitoring program include; 1, 3, 5, 6, 11, 14, 15, 16, 19, 20.

8.1.4 Feral Animal

At this stage no active works are required. It is recommended that monitoring of feral animal abundance continues and if it appears that there is an increase in abundance that a control program be implemented.

8.1.5 Fencing

In general, the Williamsdale property fence is in good condition with only minor damage in some areas. The northern section of MU7 requires fencing to exclude stock, however, it is understood that this is in the process of being implemented. Sheep grazing within MU7 has had a considerable impact on the vegetation within the management unit. This section of the offset site will not begin to recover until stock grazing is fully (and not just periodically) excluded. Stock in this section is also currently entering the broader offset site through gaps in the existing fence and gate in MU7. While the Williamsdale property fence is satisfactory condition, internal fencing needs to be erected if grazing is going to continue within Williamsdale property but outside of the offset site.

8.1.6 Weed

Weed control activities have been successful to date particularly for control of Sweet Briar. Secondary control of African Love Grass is recommended to be undertaken in 2013 around the main drainage lines near MU5 & MU6. In addition, follow up spot spraying of other weed species is also recommended to ensure an overall low occurrence of weeds in the offset site.

8.1.7 Grazing

No action is required under the grazing plan other than the exclusion of stock as discussed above. Opportunistic observations of the grazing pressure within and adjacent to the *Swainsona recta* plots indicate that the offset site is being grazed at a low to moderate intensity. Regular counts of 20-30 Eastern Grey Kangaroos were made during the monitoring program and are considered to represent more than one mob.

8.2 Management unit recommendations

A summary of the actions relating to the offset site is provided in **Table 3** below and includes recommended adaptive management actions based on the results presented in the above sections. The management actions proposed are described according to the corresponding Management Unit.

Table 3: Summary of proposed actions within each Management Unit

Management units	ODP management actions	Action status	Comments (Autumn Monitoring 2013)
MU1A	*Weeds*: Control required for *R. rubiginosa, H. perforatum, C. lanatus* and *N. trichotoma*.	Primary control for all main weed species conducted.	Maintain weed control program as outlined in ODP.
	Revegetation: Possible revegetation of overstorey Eucalypt species and / or native grasses.	To be completed / to be revised.	Overstorey planting possible after first or second years weed control. May not be required as natural regeneration evident across the site. No immediate action recommended. Continue monitoring of regrowth observed in monitoring surveys.
	Fencing: Property fencing along the southern border of the Management Unit (ACT/NSW border).	Completed in August 2012.	N/A
	Feral Animal Control: Low numbers of rabbits were observed on site. No control required at this stage. Monitoring to establish control in the future.	Pig control was undertaken in September and October 2012. Monitoring in progress.	No pigs have been evident following control. Low rabbit numbers continue to exist, but are currently considered a low risk.
	Sediment and Erosion Control: No sediment and erosion required at present. Monitoring to establish control in the future.	No action required.	Continue monitoring.
	Monitoring Plot: Plot has been established in centre of MU, within an area potentially requiring revegetation and high weed control.	Monitoring complete to date.	N/A

Management units	ODP management actions	Action status	Comments (Autumn Monitoring 2013)
MU1B	*Weeds*: Control required for *R. rubiginosa, H. perforatum* and *E. curvula*.	Primary control for all main weed species conducted.	Maintain weed control program as outlined in ODP.
	Revegetation: Possible revegetation of over storey Eucalypt species.	To be completed / to be revised.	Overstorey planting possible after first or second years weed control. May not be required as natural regeneration evident across the site. No immediate action recommended. Continue monitoring of regrowth observed in monitoring surveys.
	Fencing: Property fencing along the southern border of the Management Unit (ACT/NSW border).	Completed in August 2012.	N/A
	Feral Animal Control: Low numbers of rabbits were observed on site. No control required at this stage. Monitoring to establish control in the future.	Pig control was undertaken in September and October 2012. Monitoring in progress.	No pigs have been evident following control. Low rabbit numbers continue to exist, but are currently considered a low risk.
	Erosion Control: Limited control may be required for minor erosion on north-south drainage line and along the western edge.	Bi-annual monitoring undertaken.	Targeted monitoring following heavy rain events for specified erosion points.
	Monitoring Plot: No monitoring plot was established in this area.	Monitoring complete to date.	N/A
MU2A	*Weeds*: Control required for *R. rubiginosa* and *H. perforatum*.	Primary control for all main weed species conducted.	Maintain weed control program as outlined in ODP.

Management units	ODP management actions	Action status	Comments (Autumn Monitoring 2013)
	Revegetation: No revegetation required.	No action required.	N/A
	Fencing: No fencing required.	No action required.	N/A
	Feral Animal Control: No feral animal control required at present. Monitoring to establish control in the future.	Monitoring in progress.	No control required. Continue to monitor.
	Sediment and Erosion Control: No sediment and erosion required at present. Monitoring to establish control in the future.	No action required.	N/A
	Monitoring Plot: No monitoring plot established in this area.	Plot set up and 2012 monitoring complete.	Continue monitoring.
MU2B	*Weeds*: Control required for *R. rubiginosa, H. perforatum* and *N. trichotoma*.	Primary control for all main weed species conducted.	Maintain weed control program as outlined in ODP.
	Revegetation: No revegetation required.	No action required.	N/A
	Fencing: No fencing required.	No action required.	N/A
	Feral Animal Control: No feral animal control required at present. Monitoring to establish control in the future.	Monitoring in progress.	No control required. Continue to monitor.
	Erosion Control: No sediment and erosion required at present. Monitoring to establish control in the future.	No action required	Continue monitoring.

Management units	ODP management actions	Action status	Comments (Autumn Monitoring 2013)
	Monitoring Plot: Establish monitoring plot.	Monitoring complete to date.	N/A
MU3	*Weeds*: Control required for *H. perforatum* and heavy infestations of *R. rubiginosa* (particularly within 30-40m of Monaro Highway).	Primary control for all main weed species conducted.	Maintain weed control program as outlined in ODP.
	Revegetation: No revegetation required.	No action required.	N/A
	Fencing: Fencing along the southern border of the MU (ACT/NSW border).	Completed in August 2012.	Minor damage may require future attention in some places.
	Feral Animal Control: No feral animal control required at present. Monitoring to establish control in the future.	Pig control was undertaken in September and October 2012. Monitoring in progress.	No pigs have been evident following control. Continue to monitor.
	Erosion Control: No sediment and erosion required at present. Monitoring to establish control in the future.	Continue to monitor.	Targeted monitoring following heavy rain events for specified erosion points.
	Monitoring Plot: Two monitoring plots were established within MU3. The northern monitoring plot will function as a control plot.	Monitoring complete to date.	N/A
MU4	*Weeds*: Control required for *R. fruticosus*, *H. perforatum*, *R. rubiginosa* and other woody weeds. Heavy infestations around drainage lines and dam.	Primary control for all main weed species conducted.	Maintain weed control program as outlined in ODP. Additional targeted control around dam.

Management units	ODP management actions	Action status	Comments (Autumn Monitoring 2013)
	Revegetation: Possible revegetation surrounding the dam following weed control could be beneficial.	To be completed	Determine whether revegetation is required around dam after weed control is completed.
	Fencing: No fencing required.	No action required	Minor damage may require attention in some places.
	Feral Animal Control: No feral animal control required at present. Monitoring to establish control in the future.	Pig control was undertaken in September and October 2012. Monitoring in progress.	No pigs have been evident following control.
	Erosion Control: Erosion control may be required within the east-west drainage line east of the dam.	Biannual monitoring undertaken.	Targeted monitoring following heavy rain events for specified erosion points.
	Monitoring Plot: Monitoring plot established in the north-eastern section of the MU.	Monitoring complete to date.	N/A
MU5	*Weeds*: Control required for *R. rubiginosa* and *H. perforatum*.	Primary control for all main weed species conducted.	Maintain weed control program as outlined in ODP.
	Revegetation: No revegetation required.	No action required.	N/A
	Fencing: Fencing may be required for the south-western corner of MU.	In progress – consideration for removal of internal fencing.	Removal of internal property fences.
	Feral Animal Control: No feral animal control required at present. Monitoring to establish control in the future.	Pig control was undertaken in September and October 2012. Monitoring in progress.	No pigs have been evident following control.

Management units	ODP management actions	Action status	Comments (Autumn Monitoring 2013)
	Erosion Control: Sediment and erosion control is unlikely to be required at present.	No action required.	No erosion points currently with MU.
	Monitoring Plot: Monitoring plot established in the centre of the MU to serve as a control site.	Monitoring complete to date.	N/A
	Note: MU5 does not include the main drainage line running east-west through the offset site.	N/A	N/A
MU6	*Weeds*: Control required for *R. rubiginosa* and *H. perforatum*. Heavy infestations of *R. rubiginosa* occur along the drainage lines.	Primary control for all main weed species conducted.	Maintain weed control program as outlined in ODP.
	Revegetation: No revegetation required.	No action required.	N/A
	Fencing: No fencing required.	In progress – consideration for removal of internal fencing.	Removal of internal property fences.
	Feral Animal Control: No feral animal control required at present. Monitoring to establish control in the future.	Pig control was undertaken in September and October 2012. Monitoring in progress.	No pigs have been evident following control.
	Erosion Control: Sediment and erosion control may be required in the main drainage line running east-west. Establish permanent photo monitoring point for erosion with main-drainage line.	Photo points established. Biannual monitoring in progress.	Targeted monitoring following heavy rain events.

Management units	ODP management actions	Action status	Comments (Autumn Monitoring 2013)
	Monitoring Plot: Monitoring plot established in the far east of the MU within an area of moderate to high Sweet Briar abundance.	Monitoring complete to date.	N/A
	Note: MU6 includes the drainage line running East-West through the offset site.	N/A	N/A
MU7	*Weeds*: *R. rubiginosa* control will be required	Primary control for all main weed species conducted.	Maintain weed control program as outlined in ODP.
	Revegetation: Possible ground-layer rehabilitation maybe required. Monitoring of weed control success will inform rehabilitation needs.	To be completed	Determine whether revegetation is required for groundlayer after weed control is completed. Note, includes electricity easement so no overstorey planting permitted. Consider seeding of forbs and tussock grasses in disturbed areas.
	Fencing: No fencing required.	In progress – consideration for removal of internal fencing.	Removal of internal property fences. Minor damage requires attention to ensure stock excluded.
	Feral Animal Control: No feral animal control required at present. Monitoring to establish control in the future.	Monitoring in progress.	Pig control completed in other MU's of offset site. Remove stock from adjacent paddocks.
	Erosion Control: Erosion control is unlikely to be required at present. Monitoring will determine if future control is required.	No action required.	No erosion points within MU.

Management units	ODP management actions	Action status	Comments (Autumn Monitoring 2013)
	Monitoring Plot: Monitoring plot established within area that may require future rehabilitation of the ground-layer	Monitoring complete to date.	N/A

References

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Hamrick B, Smith M, Jaworowski C, Strickland B, 2011, *A landowners guide for wild pig management: Practical methods for wild pig control*, Mississippi State university Extension Service & Alabama Cooperative Extension System.

Appendix A: Vegetation monitoring species list

+ = 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 list for 'All' includes all species observed opportunistically and those observed inside the regular monitoring plots

Native									
Plot Number	**Opportunistic**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Species	**All**	**MU1A**	**MU2B**	**MU3**	**MU4**	**MU5**	**MU6**	**MU7**	**MU3**
Acacia mearnsii	✓								
Acacia rubida	✓								
Acaena novae-zelandiae	✓			r					
Acaena ovina	✓		+	+	1		+		+
Ajuga australis	✓								
Aristida ramosa	✓		1		+	1			2
Arthropodium minus	✓								
Asperula conferta	✓		+	1	r	+	1		+
Asplenium flabellifolium	✓								
Astroloma humifusum	✓								
Austrodanthonia caespitosa	✓	1			+	1			
Austrodanthonia carphoides	✓								1
Austrodanthonia racemosa	✓	1			2			1	
Austrodanthonia sp.	✓			1			1		
Austrostipa bigeniculata	✓	1	1		2			1	2
Austrostipa densiflora	✓								
Austrostipa scabra	✓	2	3	1	2	1	1		
Bossiaea buxifolia	✓				r				
Bossiaea prostrata	✓					+			
Bothriochloa macra	✓	1	2		2		1	1	1
Brachycome sp.	✓								
Brachyloma daphnoides	✓								
Bulbine bulbosa	✓								

Native									
Plot Number	**Opportunistic**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Species	**All**	**MU1A**	**MU2B**	**MU3**	**MU4**	**MU5**	**MU6**	**MU7**	**MU3**
Bursaria spinosa	✓			+					
Callitris endlicheri	✓								
Calocephalus citreus	✓			r					
Carex appressa	✓								
Carex inversa	✓	3		+	r	1	+	4	
Cassinia aculeata	✓				r				
Cheilanthes sieberi	✓		1	+	+	+			+
Chrysocephalum apiculatum	✓		1	+	1	1			1
Chrysocephalum semipapposum	✓				r				
Clematis microphylla	✓				r				
Convolvulus erubescens	✓		r						r
Craspedia variabilis	✓								
Crassula sieberana	✓								
Cryptandra amara	✓				r	1			
Cymbonotus lawsonianus	✓		r	r	1			r	r
Cymbopogon refractus	✓		+	r	1				
Cynoglossum suaveolens	✓								
Daucus glochidiatus	✓								
Desmodium varians	✓	r	1		1	1			+
Dianella revoluta	✓								
Dichelachne sp.	✓			1	r	1	1		+
Dichondra repens	✓		1		+				
Dichopogon fimbriatus	✓								
Dillwynia sericea	✓								
Drosera peltata	✓								
Einadia nutans	✓				r				
Elymus scaber	✓	+	1	+	+	+	+		1
Enneapogon nigricans	✓				1		+		
Epilobium billardiereanum	✓								
Erigeron karvinskianus	✓								
Erodium crinitum	✓								
Eryngium ovinum	✓			+					
Eucalyptus blakelyi	✓		+	2	2	2	2		2
Eucalyptus blakelyi (Juvenile)	✓								
Eucalyptus bridgesiana	✓								
Eucalyptus dives	✓								
Eucalyptus mannifera	✓								
Eucalyptus melliodora	✓								
Euchiton sp.	✓		+	r	r			r	r
Fimbristylis sp.	✓						r		

Native									
Plot Number	**Opportunistic**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Species	**All**	**MU1A**	**MU2B**	**MU3**	**MU4**	**MU5**	**MU6**	**MU7**	**MU3**
Gallium gaudichaudii	✓								
Geranium solanderi	✓		+	+	r		+		
Geranium sp.	✓								
Glycine clandestina	✓								
Glycine tabacina	✓		1	+		+			
Gonocarpus tetragynus	✓			+		r			1
Goodenia hederacea	✓								
Haloragis heterophylla	✓						1		
Hibbertia obtusifolia	✓								
Hydrocotyle laxiflora	✓		r					r	
Hypericum gramineum	✓		r			r	+		1
Indigofera australis	✓								
Isolepis sp.	✓								
Joycea pallida	✓								
Juncus sp.	✓	r	r	1			1		
Juncus spp.	✓							2	
Kunzea ericoides	✓								
Leptorhynchos squamatus	✓			+		+			+
Leucochrysum albicans var. *tricolor*	✓								
Linum marginale	✓								
Lomandra filiformis	✓		r	+	1	1	1		1
Lomandra multiflora	✓			r		r			r
Luzula densiflora	✓								
Melichrus urceolatus	✓		r			+			r
Microlaena stipoides	✓		1	+	1	1	1	2	
Microseris lanceolata	✓								
Microtis unifolia	✓								
Myosotis sylvatica	✓								
Oreomyrrhis eriopoda	✓		1						
Oxalis perennans	✓								
Panicum effusum	✓	r	1		1	1	1	+	1
Pimelea curviflora	✓								
Plantago varia	✓			r					
Poa sieberiana	✓			2		1	1		+
Pseudognaphalium luteoalbum	✓								
Pultenaea procumbens	✓								
Ranunculus sp.	✓								
Rumex brownii	✓								
Schoenus apogon	✓			1		1	1		+
Sebaea ovata	✓								

Native									
Plot Number	**Opportunistic**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Species	**All**	**MU1A**	**MU2B**	**MU3**	**MU4**	**MU5**	**MU6**	**MU7**	**MU3**
Senecio quadridentatus	✓		r						
Solenogyne dominii	✓								
Spergularia brevifolia	✓								
Stackhousia monogyna	✓								
Swainsona recta (propagated)	✓								
Swainsona sericea	✓								
Thelymitra pauciflora	✓								
Themeda australis	✓			4	+	4	4		4
Thysanotus patersonii	✓								
Thysanotus tuberosus	✓								
Tricoryne elatior	✓		r	r					
Triptilodiscus pygmaeus	✓								
Veronica calycina	✓								
Vittadinia cuneata	✓		1		r				
Vittadinia muelleri	✓		1		r	1			1
Wahlenbergia luteola	✓								
Wahlenbergia sp.	✓		+		r	r			
Wahlenbergia stricta	✓								
Wurmbea dioica	✓								
Total Native Species	**122**	**10**	**31**	**30**	**34**	**27**	**21**	**10**	**26**

Exotic									
Plot Number	**Opportunistic**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Species	**All**	**MU1A**	**MU2B**	**MU3**	**MU4**	**MU5**	**MU6**	**MU7**	**MU3B**
Acetosella vulgaris	✓		+		r				+
Aira sp.	✓		1	1	r	1	1		
Anagallis arvensis	✓								
Arctotheca calendula	✓								
Avena sp.	✓			r					
Briza minor	✓								r
Bromus sp.	✓	1	r				1	2	
Bromus diandrus	✓								
Bromus hordeaceus	✓								
Capsella bursa-pastoris	✓								
Carduus tenuiflorus	✓								
Carthamus lanatus	✓	2			r		r		
Centaurium erythraea	✓	+		+	+	1	+		r
Cerastium sp.	✓								
Cirsium vulgare	✓	1							
Conyza sp.	✓	1	+	r		r			r

Exotic									
Plot Number	**Opportunistic**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Species	**All**	**MU1A**	**MU2B**	**MU3**	**MU4**	**MU5**	**MU6**	**MU7**	**MU3B**
Crataegus monogyna	✓								
Cynosurus echinatus	✓		+	1					
Cyperus eragrostis	✓								
Echium plantagineum	✓								
Eragrostis cilianensis	✓						1		
Eragrostis curvula	✓			r		r		+	
Erodium cicutarium	✓								
Holcus lanatus	✓								
Hordeum sp.	✓	r							
Hypericum perforatum	✓	r	r	r	+	+	+	r	
Hypochaeris radicata	✓		+	r	+	r			r
Linaria arvense	✓								
Linaria pelisseriana	✓								
Lolium rigidum	✓								
Malva sp.	✓	+							
Marrubium vulgare	✓								
Nassella trichotoma	✓	+							
Onopordum acanthium	✓								
Orobanche minor	✓			r					
Parentucellia latifolia	✓								
Paronychia brasiliana	✓	1	+					r	
Petrorhagia nanteuilii	✓	+	+	+	1	r			
Plantago lanceolata	✓			r		r	1	r	
Polygonum aviculare	✓							r	
Prunus sp.	✓								
Rosa rubiginosa	✓	r	r	r	+	r	r	+	r
Rubus fruticosus	✓	r							
Sonchus sp.	✓								
Taraxacum officinale	✓								
Tolpis umbellata	✓								
Trifolium arvense	✓								
Trifolium campestre	✓								
Trifolium glomeratum	✓								
Trifolium repens	✓								
Trifolium sp.	✓	+		1	r	r	r	r	
Trifolium subterraneum	✓								
Verbascum thapsus	✓	r			r				
Verbena bonariensis	✓						r	r	
Vicia sp.	✓								
Vulpia sp.	✓					1			
Total Exotic Species	**56**	**11**	**9**	**10**	**9**	**8**	**6**	**9**	**6**

Appendix B: Opportunistic fauna species

Fauna species recorded in the Autumn 2013, Spring 2012, Autumn 2012 and the 2011 baseline monitoring surveys.

Table 4 Opportunistic fauna species. A = Autumn, B = Spring

Common Name	Latin Name	2011	2012A	2012B	2013A
Australasian Grebe	*Tachybaptus novaehollandiae*	☐	✓	☐	✓
Australian Magpie	*Gymnorhina tibicen*	✓	✓	✓	✓
Australian Raven	*Corvus coronoides*	✓	✓	✓	✓
Australian Wood Duck	*Chenonetta jubata*	☐	☐	✓	✓
Black-faced Cuckoo-Shrike	*Coracina novaehollandiae*	☐	✓	✓	☐
Common Bronzewing	*Phaps chalcoptera*	✓	☐	☐	✓
Crested Pigeon	*Ocyphaps lophotes*	☐	☐	☐	✓
Diamond Firetail	*Stagonopleura guttata*	✓	☐	☐	✓
Double Barred Finch	*Taeniopygia bichenovii*	☐	☐	☐	✓
European Goldfinch	*Carduelis carduelis*	☐	☐	☐	✓
Galah	*Eolophus roseicapillus*	✓	☐	✓	☐
Grey Butcherbird	*Cracticus torquatus*	☐	✓	✓	☐
Grey Fantail	*Rhipidura albiscapa*	✓	✓	✓	☐
Grey Shrike-Thrush	*Colluricincla harmonica*	☐	✓	☐	✓
Hard Head	*Aythya australis*	☐	☐	✓	✓
Honeyeater, White-Eared	*Lichenostomus penicillatus*	✓	✓	☐	✓
Honeyeater, White-Plumed	*Lichenostomus penicillatus*	☐	☐	☐	✓
Honeyeater, Yellow Faced	*Lichenostomus chrysops*	☐	☐	✓	☐
Jacky Winter	*Microeca fascinans*	✓	☐	✓	☐
Kookaburra	*Dacelo novaeguineae*	✓	☐	✓	☐
Leaden Flycatcher	*Myiagra rubecula*	☐	☐	✓	☐
Magpie Lark	*Grallina cyanoleuca*	✓	✓	✓	✓
Noisy Friarbird	*Philemon corniculatus*	☐	☐	✓	☐
Noisy Miner	*Manorina melanocephala*	✓	✓	✓	✓
Pacific Black Duck	*Anas superciliosa*	☐	☐	✓	✓
Pardalote, Spotted	*Pardalotus punctatus*	✓	✓	✓	✓
Pardalote, Striated	*Pardalotus striatus*	✓	☐	✓	✓
Pied Currawong	*Strepera graculina*	✓	✓	✓	✓
Quail	*Coturnix sp.*	✓	☐	☐	☐
Red-Browed Finch	*Neochmia temporalis*	☐	☐	✓	✓
Robin, Flame	*Petroica phoenicea*	✓	☐	☐	☐
Robin, Hooded	*Melanodryas cucullata cucullata*	✓	☐	☐	☐
Robin, Scarlet	*Petroica boodang*	☐	✓	☐	✓
Rosella, Crimson	*Platycercus elegans*	✓	✓	✓	✓
Rosella, Eastern	*Platycercus adscitus*	✓	✓	✓	✓
Sacred Kingfisher	*Todiramphus sanctus*	☐	☐	✓	☐
Speckled Warbler	*Chthonicola sagittatus*	☐	☐	☐	✓
Sulphur-Crested Cockatoo	*Cacatua galerita*	✓	☐	☐	☐
Superb Fairy Wren	*Malurus cyaneus*	✓	✓	✓	✓
Thornbill, Brown	*Acanthiza pusilla*	✓	☐	✓	✓
Thornbill, Yellow	*Acanthiza nana*	✓	☐	☐	☐
Thornbill, Yellow-Rumped	*Acanthiza chrysorrhoa*	✓	✓	✓	✓
Wedge-Tailed Eagle	*Aquila audax*	✓	✓	☐	✓

Common Name	Latin Name	2011	2012A	2012B	2013A
Weebill	*Smicrornis brevirostris*	☐	☐	☐	✓
Whistler, Golden	*Pachycephala pectoralis*	✓	✓	☐	☐
Whistler, Rufous	*Pachycephala rufiventris*	☐	☐	✓	✓
White Throated Tree Creeper	*Cormobates leucophaeus*	✓	✓	✓	✓
White-fronted Gerygone	*Gerygone olivacea*	☐	☐	✓	☐
White-winged Chough	*Corcorax melanorhamphos*	☐	✓	✓	☐
Willie Wagtail	*Rhipidura leucophrys*	✓	✓	☐	✓
Yellow Tailed Black Cockatoo	*Calyptorhynchus funereus*	☐	☐	☐	✓
		☐	☐	☐	☐
Mammals	**Latin Name**	**2011**	**2012A**	**2012B**	**2013A**
Cow	*Bos Taurus*	✓	☐	☐	☐
European Rabbit	*Oryctolagus cuniculus*	✓	✓	✓	✓
Feral Goat	*Capra aegagrus hircus*	☐	✓	✓	☐
Feral Pig	*Sus scrofa*	☐	✓	☐	☐
Fox	*Vulpes vulpes*	✓	✓	✓	✓
Kangaroo	*Macropus giganteus*	✓	✓	✓	✓
Wombat	*Vombatus ursinus*	✓	✓	✓	✓
Sheep	*Ovis aries*				✓
Other	**Latin Name**	**2011**	**2012A**	**2012B**	**2013A**
Eastern Bearded Dragon	*Pogona barbata*	☐	☐	✓	☐
Eastern Common Froglet	*Crinia signifera*	☐	✓	✓	✓
Eastern Long-necked Tortoise	*Chelodina longicollis*	☐	✓	☐	✓
Mountain Dragon	*Rankinia diemensis*	✓	☐	☐	☐
Plains Froglet	*Crinia parinsignifera*	☐	☐	✓	☐
Spotted Marsh Frog	*Limnodynastes tasmaniensis*	☐	☐	✓	☐

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