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# M2G Seeding (Plot) Monitoring Report

## Construction Corridor (Autumn 2015)

Prepared for
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# Contents

# List of figures



# List of tables

# Plates

# Abbreviations

| ABBREVIATION | DESCRIPTION |
|---|---|
| BGGW | Box Gum Grassy Woodland |
| KPT | Key Performance Targets |
| LLPS | Low Lift Pump Station |
| LRMP | Landscape Rehabilitation Management Plan (superseded by the LRTEMP) |
| LRTEMP | Landscape Rehabilitation and Terrestrial Ecology Management Plan |
| M2G | Murrumbidgee to Googong Water Transfer Project |
| NTG | Natural Temperate Grassland |
| ORMP | Offset Rehabilitation Management Plan |
| PCS | ACT Parks and Conservation Service |
| TEMP | Terrestrial Ecology Management Plan (superseded by the LRTEMP) |

# 1 Executive Summary

This report presents the results of the autumn 2015 plot monitoring survey for the seeding rehabilitation of the M2G pipeline construction project. Current surveys were conducted between 18 – 24 April 2015.

Floristic data were collected from twenty monitoring plots located within the 12km M2G construction corridor and two control plots placed in moderate to high diversity box gum grassy woodland adjacent to the construction corridor.

A total of 128 herbaceous species (70 native and 58 non-native) were recorded in monitoring plots. Native species richness ranged from 10 to 34 sp. at an average of 20.3 sp. per plot. In contrast non-native richness ranged from 12 to 24 and averaged 16.7. As anticipated, native species richness and cover abundance were significantly higher in control plots, which had an average of 32 native sp. per plot and cover abundances above 90%.

All six plots associated with non-native vegetation (category 1) have now met the required Key Performance Target (KPT) and relevant paddocks have either been or are in the process of being returned to landowners. Although no plot associated with native vegetation (categories 2 and 3) met the required KPT plot 17 is near the target, and there were measurable increases in native cover abundance across most other plots.

The highest individual native species cover score was 3 (25-50%) attained by *Bothriochloa macra* and *Panicum effusum* across four plots, followed by seven native species (including the two just mentioned) with cover scores of 2 (5-25%) across seventeen plots. The remaining 63 native species had individual cover scores below 5%. This represented an increase in total native cover abundance relative to previous monitoring periods. The increase in native species was coupled with an encouraging reduction in non-native species cover abundance, largely due to seasonal declines in annual pasture grasses; primarily *Bromus* spp. and legumes, such as *Trifolium* spp., and to a lesser extent broadleaf weeds.

Eight noxious species were recorded within the construction corridor. While most infestations were minor and manageable outbreaks of *Echium vulgare* (Vipers Bugloss), *Eragrostis curvula* (African Lovegrass) and *Hypericum perforatum* (St John's Wort) could manifest into more serious infestations and should be attended to. The wider local occurrence of these species will, however, pose continued management problems.

The main recommendations are:

- continue chemical weed control though minimise the impact on non-target species;
- 'pulse' grazing should be repeated in the central section of the construction corridor in late winter 2015 and again if required during the following summer/autumn 2016 period. Consideration should also be given to adopting a similar approach in other sections of the corridor that contain high biomass and/or broadleaf weed infestations;
- undertake re-seeding in areas where native germination has been poor subsequent to effective weed management;
- as previously stated, Icon should consider undertaking a trial application of carbohydrate (sugar) in ACT sections of the corridor where native germination and recovery has been particularly poor (i.e. Plots 24 and 25): and,

- KPTs for category 3 and 2 vegetation should be reviewed with consideration given to lowering the former category to 60% native vegetation cover and the later to 50% native vegetation cover.

# 2 Introduction

## 2.1 Background

This report provides the results and analysis of the autumn 2015 plot monitoring survey for the seeding rehabilitation of the Murrumbidgee to Googong Water Transfer Project (M2G) construction corridor. This is the seventh in a series of bi-annual reports examining the post-construction vegetation recovery of the M2G construction corridor.

Twenty-five monitoring plots were established within the construction corridor (ten in the ACT and fifteen in the NSW sections of the corridor) following the completion of construction works and re-seeding operations in autumn 2012. Two control plots were later set within moderate to good condition Box Gum Grassy Woodland in the ACT and have been monitored since spring 2013.

Background documents and information required for this study were presented in the initial M2G Rehabilitation Monitoring Autumn 2012 Report (Blue Gum Ecological Consulting, July 2012).

## 2.2 Study area

The M2G construction corridor (study area) extends from Angle Crossing on the Murrumbidgee River to Burra Creek at the intersection of Williamsdale and Burra Roads, a distance of about 12km.

The study area falls entirely within the Williamsdale (8726-4N) 1:25,000 Map Sheet.

## 2.3 Study aims

The main purpose of the study is to monitor post-construction vegetation recovery within the M2G construction corridor and measure the results against specific Key Performance Targets (KPTs) for each vegetation category (**Table 1**).

*Note: Icon is seeking approval to reduce the current KPT for category 3 (high conservation value vegetation) and category 2 (low diversity native vegetation) to 60% and 50%, respectively. This is discussed further in Section 5.6.*

**Table 1: Key performance targets (KPTs) for each vegetation category within the M2G construction corridor. This table has been reproduced from Table 3.2 in the Landscape Rehabilitation and Terrestrial Ecology Management Plan (LRTEMP), January 2014.**

| Vegetation Category | Key Performance Targets |
|---|---|
| 1. Non-native vegetation | **Ground cover -** > 70% vegetation cover of the species sown.<br><br>**Weeds** – better than or equal to the current presence of declared weeds and < 20% cover of exotic species not sown |
| 2. Native vegetation (low diversity) | **Ground cover -** > 70% vegetation cover of the native species sown.<br><br>**Weeds** – better than or equal to the current presence of declared weeds and < 20% cover of exotic species not sown |
| 3. High conservation value grassland and grassy woodland | **Ground cover -** > 70% vegetation cover of the native species sown and survival of native ground and tree species.<br><br>**Weeds** - better than or equal to the current presence of declared weeds and < 20% cover of exotic species not sown.<br>**Native species** (planting success) - all species listed for seeding and planting are present. |

# 3 Methods

## 3.1 Monitoring regime

Twenty-five sample plots were originally established within M2G construction corridor during 2012 and have been monitored on a bi-annual basis (autumn and spring/summer periods) since that time.

The current autumn survey was conducted between 18 and 24 April 2015 with vegetation data collected from twenty[1] monitoring plots and two control plots (**Table 2**).

## 3.2 Monitoring plots

All monitoring plots are 400m$^2$ in size and were placed at selected locations within the M2G construction corridor (**Figures 1 – 4** in Appendix 1). Plots were located to account for differences in physical condition (i.e. elevation, slope and aspect) and former vegetation according to three broad categories: non-native; native-low diversity and native-high conservation value, outlined in **Table 1,** above.

**Table 2: Monitoring plots listed in order of chainage from the LLPS. Also shown are pre-construction vegetation types in which plots were placed, post-construction seeding regime and KPT for each plot and whether these were achieved and when.**

| Plot ID | Chainage (m) | Jurisdiction | Original vegetation | Seeding regime | KPT category | Was KPT met | When KPT was achieved |
|---|---|---|---|---|---|---|---|
| **16** | 250 | ACT-PCS | NTG | N | 3 | No | - |
| **15** | 530 | ACT-PCS | NTG | N | 3 | No | - |
| **21** | 700 | ACT PCS | NTG | N | 3 | No | - |
| **19** | 1020 | ACT-PCS | Degraded BGGW | N | 2 | No | - |
| **20** | 1200 | ACT-Icon | Degraded BGGW | N | 2 | No | - |
| **18** | 1450 | ACT-Icon | Degraded BGGW | N | 2 | No | - |
| **23** | 1740 | ACT-Icon | Degraded BGGW | N | 3 | No | - |
| **22** | 2150 | ACT-Icon | BGGW | N | 3 | No | - |
| **24** | 2650 | ACT-Icon | BGGW | N | 3 | No | - |
| **25** | 2800 | ACT-Locke | BGGW | N | 3 | No | - |
| **01** | 3030 | NSW-Smith | Low to moderate diversity secondary grassland | N | 3 | No | - |
| **02** | 3220 | NSW-Smith | Low to moderate diversity *E. dives - E. mannifera* dry forest | N | 2 | No | - |
| **03** | 3320 | NSW-Smith/McDonald | Degraded BGGW | N | 2 | No | - |

[1] Five plots (07, 08, 11, 13 and 14) previously met the required KPT and therefore require no further sampling.

| Plot ID | Chainage (m) | Jurisdiction | Original vegetation | Seeding regime | KPT category | Was KPT met | When KPT was achieved |
|---|---|---|---|---|---|---|---|
| **09** | 3600 | NSW-McDonald | Low to moderate diversity secondary grassland | N | 3 | No | - |
| **04** | 4025 | NSW-McDonald | Moderate to high diversity secondary grassland | N | 3 | No | - |
| **05** | 4300 | NSW-McDonald | Low diversity native pasture | N | 2 | No | - |
| **06** | 4900 | NSW-Lonergan | Low diversity native pasture | N | 2 | No | - |
| **07** | 5200 | NSW-Lonergan | Low diversity mixed pasture | M | 1 [B] | **Yes** | **Autumn 2014** |
| **08** | 5680 | NSW-Lonergan | Poor quality mixed pasture | E | 1 | **Yes** | **Spring 2013** |
| **10** | 6030 | NSW-Codd/Howarth | Low diversity native pasture | N | 2 [A] | No | - |
| **11** | 6450 | NSW-Johanson | Poor quality mixed pasture | E | 1 [B] | **Yes** | **Spring 2014** |
| **17** | 7600 | NSW-Devitt | Moderate to high diversity BGGW | N | 3 | Near | - |
| **12** | 8300 | NSW-Bos | Poor quality mixed pasture | E | 1 [B] | **Yes** | **Current survey** |
| **14** | 9850 | NSW-Borgia | NNP | E | 1 | **Yes** | **Spring 2012** |
| **13** | 10950 | NSW-Johnston | NNP | E | 1 | **Yes** | **Spring 2012** |

[A] KPT was revised upwards from category 1 to category 2 on the basis of the landscape seeding and planting regime in these paddocks.

[B] KPT was revised downwards from category 2 to category 1 on the basis of the landscape seeding and planting regime in these paddocks.

### Key to Original Vegetation

- **NTG** = Natural Temperate Grassland.
- **BGGW** = Box Gum Grassy Woodland.
- **NNP** = Non-native Pasture

### Key to Seeding Regime

- **N** = native seed mix – *Rytidosperma* (Syn. *Austrodanthonia) carphoides, Austrostipa scabra, Bothriochloa macra, Elymus scaber, Microlaena stipoides, Chloris truncata and Themeda australis.*
- **E** = exotic seed mix - As for native seed mix combined with *Lolium perenne, Phalaris aquatica, Dactylis glomerata* and *Trifolium subterraneum.* The Johanson property (Plot 11) was seeded with an 'Alpaca Pasture Mix' comprising: Tall Fescue and Au Triumph Fescue, (*Fescue* sp.), Kara Cocksfoot (*Dactylis glomerata*), Leura Sub-clover (*Trifolium subterraneum*), Prestige White Clover (*Trifolium repens*), Tonic Plantain (*Plantago lanceolata*) and Grouse Chickory (*Cichrium intybus*).
- **M** = a mixed combination of native & exotic seed.

### 3.3 Control plots

Two control plots were established within moderate to high quality BGGW situated adjacent to the construction corridor (**Table 3**). For practical reasons (i.e. presence of stock and access restrictions) both plots were located in the ACT (**Figure 1** in Appendix 1).

**Table 3: Location of control plots.**

| Plot | Jurisdiction | Plot configuration (m) | Easting | Northing | Vegetation type/condition |
|---|---|---|---|---|---|
| **Control 1** | ACT | 20 x 20 | 692162 | 6060624 | Moderate to high floristic diversity BGGW |
| **Control 2** | ACT | 20 x 20 | 693379 | 6060670 | Moderate to high floristic diversity BGGW |

### 3.4 Survey techniques

Estimates of species presence, richness and cover abundance within sample plots were determined using a modified Braun-Blanquet scale, as shown below:

- r = < 5% cover and solitary (1-3 individuals)
- + = < 5% cover and few (4-15 individuals)
- 1 = < 5% cover and numerous/scattered (>15 individuals)
- 2 = 5% – 25% cover
- 3 = 25% – 50% cover
- 4 = 50% – 75% cover
- 5 = > 75% cover.

### 3.5 Limitations and observations

Some sections of the construction corridor, including a number of sampling plots (particularly in the ACT and the McDonald property in NSW) were affected by repeated vehicle traffic and have varying degrees of soil compaction and subsequent poor seed germination. This effect, though still evident, has diminished.

The ability of the observer to detect all species, particularly those that occur at low densities or easily obscured due to habit, can be hampered by high cover abundances of both native (i.e. *Panicum effusum*) and non-native annuals, in particular *Brome* spp., *Trifolium* spp. and some broad-leaf weeds.

# 4 Results

Results and analysis of the current monitoring survey are provided in the following sub-sections: *Overview: All monitoring plots* (Section 4.1); *Control plots* (Section 4.2); *Monitoring plots – category 3: high conservation value vegetation* (Section 4.3); *Monitoring plots – category 2: low diversity native vegetation* (Section 4.4); and, *Monitoring plots – category 3: non-native vegetation* (Section 4.5).

Plot data sets for the current surveys are presented in **Table 9** and **Table 10** in **Appendix 2**.

## 4.1 Overview: All monitoring plots

A total of 128 herbaceous plants comprising 70 native species and 58 exotic species (ratio of 1:0.84)[2] were recorded from twenty monitoring plots during the current sampling period. Comparative species counts for all sampling periods are provided in **Chart 1.**

Initial patterns in native and exotic species occurrence showed relative (as well as proportional) declines in autumn and increases in spring (**Chart 1**, below). This pattern persisted for native species up to autumn 2014, after which species numbers appear to have stabilised at about 70. Exotic species, on the other hand, have exhibited a more consistent pattern of seasonal fluctuation (spring 2013 being the exception) though in combination with a trend that has seen species numbers decline by almost 50% since spring 2012 (**Chart 1**).

### 4.1.1 Species Frequency

Sixteeen native species and 14 exotic species were present in 10 or more monitoring plots. This compared with 17 and 21 species, respectively, for the previous spring 2014 survey.

Of the ten most commonly recorded species nine were native and one exotic (six and four, respectively, in spring 2014). The most commonly recorded native species were: *Panicum effusum* (Hairy Panic), *Chloris truncata* (Windmill Grass) and *Bothriochloa macra* (Red Grass) in 20 plots; *Themeda australis* (Kangaroo Grass) and *Elymus scaber* (Common Wheatgrass) 19 plots; and *Oxalis perennans* (wood sorrel), *Microlaena stipoides* (Weeping Grass), *Austrostipa scabra* (Speargrass) and *Rytidosperma* sp. (Wallaby Grass) 18 plots. Exotic *Vulpia* sp. (Rat's Tail Fescue) was present in 17 plots.

### 4.1.2 Species Diversity (richness)

Native species richness ranged from 10 to 34 sp. per plot (comparable to the previous survey), and for non-native species the range was 12 to 25 (down from 17 to 29 in the previous survey).

At the commencement of surveys (autumn 2012) native species average per plot was 15.8. This figure increased in each subsequent survey up to spring 2013, when it peaked at 23.7 sp./plot. Since then the average has remained more or less constant at between 20.3 and 22 native sp./plot (**Chart 2**).

It is worth noting that the decline in total native species in autumn 2013 (**Chart 1**) did not affect the overall native species average per plot, which continued to rise (**Chart 2**). This suggests that native

[2] Previous native/exotic species ratios were: **1:1.23** (autumn 2012); **1:1.27** (spring 2012); **1:1.25** (autumn 2013); **1:0.98** (spring 2013); **1:0.99** (autumn 2014) and **1:1.07** (spring 2014).

species were widespread (notwithstanding their low frequency and cover abundance) in areas of former native vegetation.

Non-native species on the other hand have plots averages that continue to fluctuate in line with seasonal influences, but which are exhibiting a trend decline.

**Chart 1: Total species counts during all monitoring periods.**

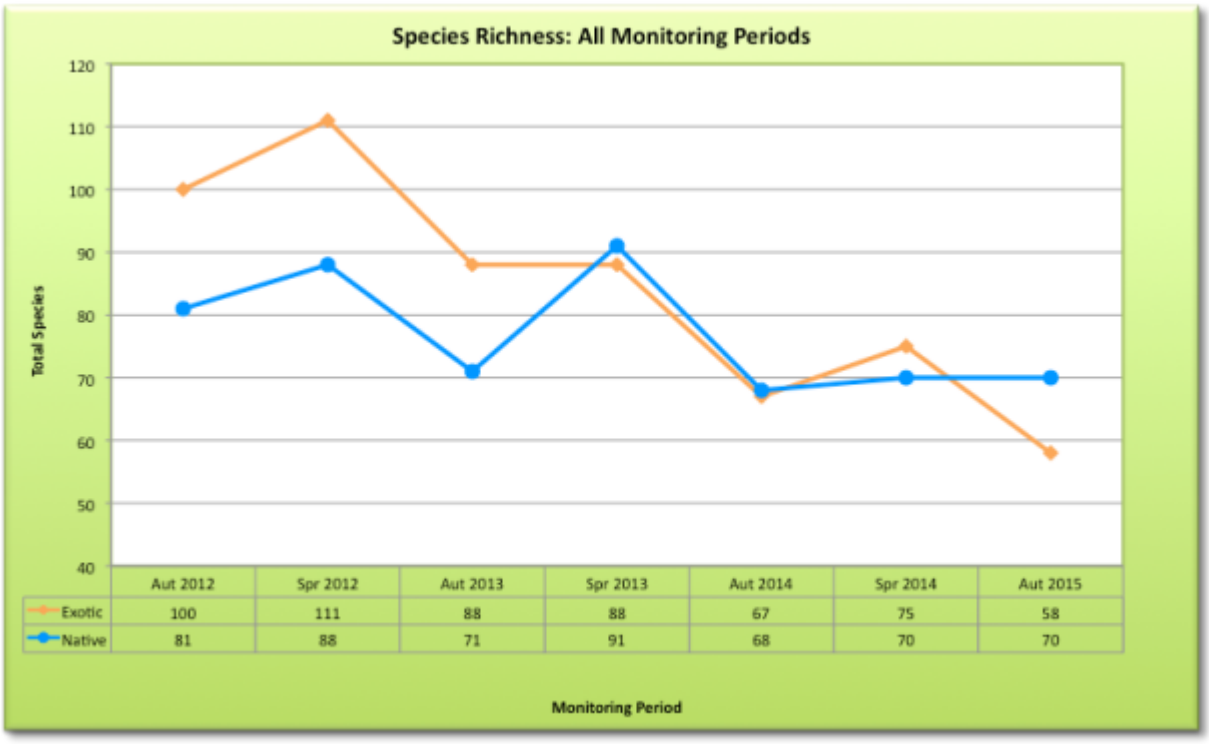
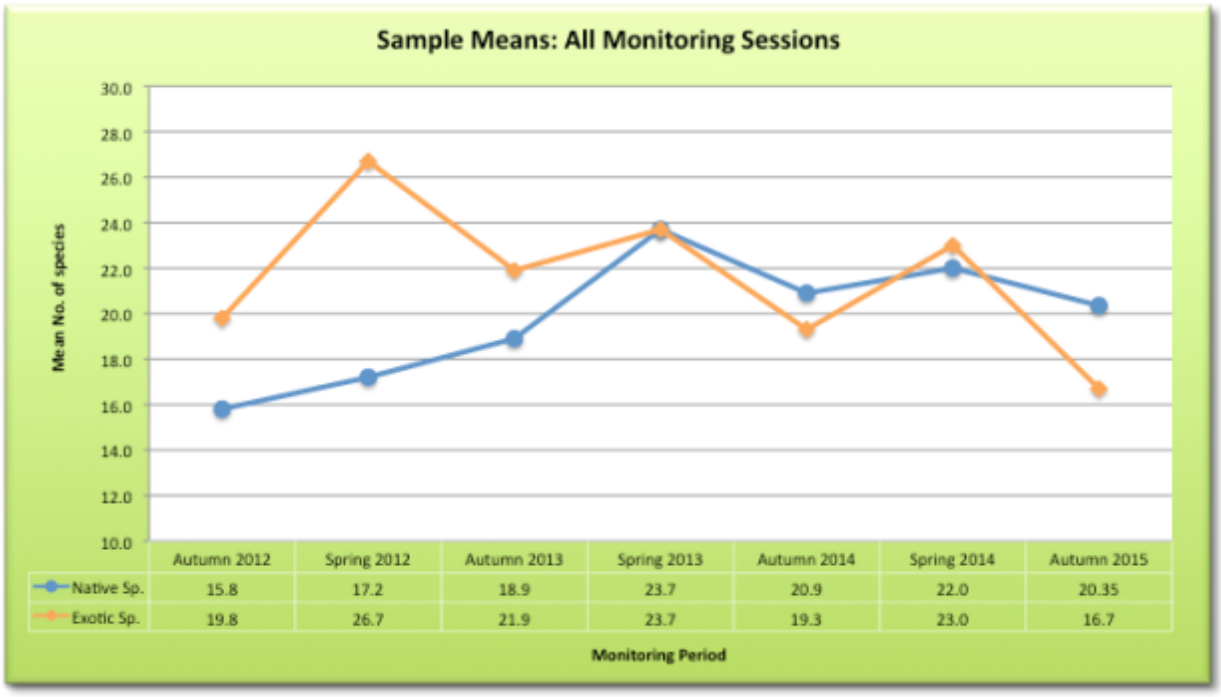



**Chart 2: Species means (per plot) during all monitoring periods.**



### 4.1.3 Cover Abundance - native vegetation plots

Fifteen of the nineteen plots (78%) associated with native vegetation (KPT categories 2 and 3) exhibited increases in native vegetation cover, two plots maintained their native cover and one plot declined relative to the previous monitoring period**.**

The best performing plots in the ACT were: 18 and 20, which attained a native species cover score in the upper limit of the 25-50% range, and plots 16, 19, 22 and 23 which scored at the lower end of the same range. In NSW, Plot 17 scored in mid to high end of the 50-75% cover range; three plots (04, 05 and 09) scored at the higher end of the 25-50% range with another four plots (02, 03, 06 and 10) in the low to mid end of that range.

Estimated total native species cover rose by between 10-15% from the previous sampling period and is now at the upper end of the 25-50% range. The estimated total cover of exotic species fell from 50-75% to 25-50% cover range (**Table 4**). The decrease in exotic species cover is associated with a decline in annual species, particularly *Bromus* spp. and clovers *Trifolium* spp and to a lesser extent *Plantago lanceolata* and *Vulpia* sp.

### 4.1.4 Cover Abundance – non-native vegetation plots

All six plots (07, 08, 11, 12, 13 and 14)[3] associated with non-native vegetation have met the required KPT (**Table 4).**

[3] The KPT for Plot 07, 11 and 12 were revised down from category 2 to category 1 on the basis of the high component of non-native perennial pasture grasses (i.e. *Phalaris aquatica, Lolium perenne* and *Dactylis glomerata*) that were included in landscape seeding mix.

**Table 4: Estimated cover abundances from all plots for spring 2014 and autumn 2015 monitoring periods. Red text indicates an increase in cover, blue a decrease and black no change compared to the previous monitoring period. The last two columns provide outcomes for revised KPTs for category 3 (60%) and category 2 (50%), should they be accepted.**

| Plot No. | Chainage | Location | Estimated total vegetation cover | | | | KPT Category | All Categories 70% KPT achieved? | Adjusted KPT | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Spring 2014 | | Autumn 2015 | | | | Cat 3 60% KPT achieved? | Cat 2 50% KPT achieved? |
| | | | Native | Exotic | Native | Exotic | | | | |
| 16 | 250 | ACT | 25-50- | 5-25 | 25-50- | <5 | 3 | No (mid range) | No (mid range) | - |
| 15 | 530 | ACT | 5-25 | 25-50 | 5-25+ | 25-50 | 3 | No | No | - |
| 21 | 700 | ACT | 5-25+ | 25-50 | 5-25 | <5 | 3 | No | No | - |
| 19 | 1020 | ACT | 5-25+ | 5-25+ | 25-50- | <5 | 2 | No (mid range) | - | No (mid range) |
| 20 | 1200 | ACT | 25-50- | 50-75 | 25-50+ | 5-25+ | 2 | No (mid range) | - | Near |
| 18 | 1450 | ACT | 25-50- | 50-75 | 25-50+ | 5-25+ | 2 | No (mid range) | - | Near |
| 23 | 1740 | ACT | 5-25+ | 25-50 | 25-50- | 5-25+ | 3 | No (mid range) | No (mid range) | - |
| 22 | 2150 | ACT | 5-25+ | 25-50 | 25-50- | <5 | 3 | No (mid range) | No (mid range) | - |
| 24 | 2650 | ACT | 5-25 | 5-25 | 5-25+ | 5-25- | 3 | No | No | - |
| 25 | 2800 | ACT | 5-25+ | 25-50 | 5-25+ | 5-25 | 3 | No | No | - |
| 1 | 3030 | Smith | 5-25 | 5-25+ | 5-25+ | 5-25 | 3 | No | No | - |
| 2 | 3220 | Smith | 5-25+ | 5-25 | 25-50- | 5-25 | 2 | No (mid range) | - | No (mid range) |
| 3 | 3320 | MacDonald | 5-25+ | 25-50+ | 25-50 | 25-50+ | 2 | No (mid range) | - | No (mid range) |
| 9 | 3600 | MacDonald | 25-50 | 50-75- | 25-50+ | 5-25- | 3 | No (mid range) | No (mid range) | - |
| 4 | 4025 | MacDonald | 25-50 | 25-50 | 25-50+ | 5-25 | 3 | No (mid range) | No (mid range) | - |
| 5 | 4300 | MacDonald | 25-50- | 50-75 | 25-50+ | 25-50- | 2 | No (mid range) | - | Near |
| 6 | 4900 | Lonergan | 5-25+ | 25-50+ | 25-50- | 5-25+ | 2 | No (mid range) | - | No (mid range) |
| 7 | 5200 | Lonergan | 5-25 | 50-75+ | - | - | 1[B] | Yes | - | - |
| 8 | 5680 | Lonergan | - | - | - | - | 1 | Yes | - | - |
| 10 | 6030 | Codd-Howath | 25-50- | 25-50 | 25-50- | 25-50+ | 2[A] | No (mid range) | - | No (mid range) |
| 11 | 6450 | Johanson | 5-25- | 50-75+ | - | - | 1[B] | Yes | - | - |
| 17 | 7600 | Devitt | 50-75- | 5-25 | 50-75 | 5-25- | 3 | Near | Yes | - |
| 12 | 8300 | Bos | <5 | 50-75 | <5 | 50-75+ | 1[B] | Yes | - | - |
| 14 | 9850 | Borgia | - | - | - | - | 1 | Yes | - | - |
| 13 | 10950 | Johnston | - | - | - | - | 1 | Yes | - | - |
| **Total cover estimate all plots** | | | 25-50- | 50-75 | 25-50 | 25-50+ | | | | |

[A] KPT was revised upwards from category 1 to category 2 on the basis of the landscape seeding and planting regime in these paddocks.

[B] KPT was revised downwards from category 2 to category 1 on the basis of the landscape seeding and planting regime in associated paddocks.

+ = cover estimated at the upper end of range

- = cover estimated at the lower end of range

## 4.2 Control plots

Both Control plot 1[4] and 2 (**Plate 1**) had moderate to high native species richness with 37 and 27 herbaceous species, respectively and cumulative native cover abundances that exceed 90%. Exotic species richness declined from the previous monitoring period and cumulative exotic species cover abundance fell to less than 5%, in response to seasonal declines of *Trifolium* spp. (see **Table 9 in Appendix 2)**.

Although some monitoring plots (i.e. 02, 17, 20 and 22) had comparable native species richness their overall cover abundance was significantly lower than that observed in control plots.

**Plate 1: Control Plots. Left column shows control plot 1 and the right control plot 2 between spring 2013 and autumn 2015.**

**Autumn 2015**

**Control Plot 1**

**Control Plot 2**

**Spring 2014**

[4] The land on which Control Plot 1 is located is no longer managed by Icon Water and it is unknown if the plot can be accessed for future monitoring.

**Autumn 2014**

**Spring 2013**

### 4.3 Plots in high-diversity native vegetation (KPT category 3)

Eleven plots were established in areas of former high conservation value vegetation (category 3) and were set the highest KPT, see **Section 2.3, above** (Icon Water proposes that the current KPT for category 3 be lowered from 70% to 60%). Summaries of survey results are provided in **Table 5**, below, with additional descriptions of each plot presented in the succeeding sub-sections.

While no category 3 plot met the required KPT Plot 17 has successive native species cover score of 4 (50-75% range), and is near the required target. Five plots had native cover scores of 3 (25-50%) and are in the mid-range of the KPT (**Table 5**). These results show an increase in total native cover abundance in category 3 plots relative to the previous spring 2014 survey.

***Species richness***

Native species ranged from 12 to 34 sp./plot at an average of 21.2 sp. (23.6 sp. in spring 2014), and non-native species ranged from 12 to 28 sp./plot at an average of 15.8 sp. (22.9 in spring 2014).

***Individual species cover abundance scores***

The highest individual native species cover score was 3 (25-50%) obtained by *Bothriochloa macra* (Plot 09). Six species had cover scores of 2 (5-25%) and were recorded on eighteen separate occasions across ten plots. Species with a cover score of 1 (<5% cover, >15 individuals) were recorded on 104 occasions.

The highest individual cover score for a non-native herbaceous species (or genus) was 3 (25-50%) obtained by *Verbena bonariensis* in Plot 15, followed by three species with cover scores of 2 (5-25%) (*Brome* sp. (Plot 23), *Paspalum dilataum* (Plot 25) and *Hypochaeris radicata* (Plot 01).

***Cumulative cover abundance scores***

Cumulative native cover increased in eight plots, remained unchanged in two plots and declined in one (**Table 5**). *Overall, there was an increase in total native species cover in this category* (*which now sits at the mid point of the 25-50% range*) *compared to the previous sampling period.* While this is an encouraging result it is doubtful that this trend would continue uninterrupted and reaching the 70% KPT will be difficult.

Cumulative non-native cover declined in five plots and remained stable in two plots and increased in one (**Table 5**). *Overall, there was a decline in total non-native species cover in this category.*

**Table 5: Summary of category 3 plot results for the current autumn 2015 survey. Table provides plot data on: current species richness and changes from spring 2014; native species with cover scores of 1 or more; and cumulative cover abundance estimates for native and exotic species.**

**Parentheses ( ) enclose results from spring 2014 and red text identifies an increase in species, blue a decrease and black no change.**

| Plot No. | Chainage | Location | Native sp. | Exotic sp. | Total sp. | Change native sp.* | Change exotic sp.* | Native sp. cover score of 1 | Native sp. cover score of 2 > | Total native cover % | Total exotic cover % |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **16** | 250 | ACT | **26** | **22** | **48** | **0** (6) | 3 (2) | **8** (8) | **3** (3) | **25-50-** | <5 |
| **15** | 530 | ACT | **20** | **22** | **42** | **0** (1) | 7 (-3) | 10 (12) | 1 (0) | **5-25+** | **25-50** |
| **21** | 700 | ACT | **12** | **13** | **25** | 10 (6) | 12 (0) | 8 (10) | **0** (0) | 5-25 | <5 |
| **23** | 1740 | ACT | **24** | **19** | **43** | 4 (7) | 2 (8) | 10 (7) | **1** (1) | **25-50-** | 5-25+ |
| **22** | 2150 | ACT | **27** | **15** | **42** | 1 (2) | 5 (3) | 9 (10) | 2 (0) | **25-50-** | <5 |
| **24** | 2650 | ACT | **14** | **13** | **27** | **0** (2) | 12 (12) | 6 (7) | 1 (0) | **5-25+** | 5-25- |
| **25** | 2800 | ACT | **17** | **16** | **33** | 2 (-5) | 11 (1) | 8 (6) | **1** (1) | **5-25+** | 5-25 |
| **01** | 3030 | NSW-Smith | **17** | **15** | **32** | 6 (3) | 7 (8) | **8** (8) | 1 (0) | **5-25+** | 5-25 |
| **09**[P] | 3600 | NSW-McDonald | **22** | **13** | **35** | 7 (6) | 4 (2) | 12 (11) | 2[A] (2) | **25-50+** | 5-25- |
| **04**[P] | 4025 | NSW-McDonald | **18** | **12** | **30** | 2 (2) | 9 (10) | 7 (10) | 4 (2) | **25-50+** | 5-25- |
| **17** | 7600 | NSW-Devitt | **34** | **14** | **48** | 1 (2) | 7 (0) | 18 (16) | 3 (2) | **50-75** | 5-25- |
| **Av autumn 2015** | | | **21.0** | **15.8** | **36.8** | | | | | 25-50 | 5-25- |
| Av spring 2014 | | | 23.6 | 22.9 | 46.5 | | | | | 25-50- | 25-50 |
| Av autumn 2014 | | | 20.7 | 18.5 | 39.2 | | | | | 5-25+ | 5-25+ |
| Av spring 2013 | | | 26.4 | 24.7 | 51.1 | | | | | | |
| Av. autumn 2013 | | | 20.4 | 22.4 | 42.9 | | | | | | |
| Av. spring 2012 | | | 19.9 | 29.2 | 49.1 | | | | | | |
| Av. autumn 2012 | | | 17.3 | 19.4 | 30.1 | | | | | | |

* Change in species richness in the period between autumn 2014 and spring 2014.

[P] pulse grazed prior to autumn 2014 sampling period

+ cover estimated at the upper end of range

- cover estimated at the lower end of range

[A] =includes species with cover score of 3 (25-50%)

### 4.3.1 Monitoring Plot 16

| Jurisdiction | ACT |
|---|---|
| Native sp. cumulative cover % | **25-50-** (25-50-) |
| No. Native sp. with cover score of 1 | **8** (8) |
| No. Native sp. with cover score of 2 or more | **3** (3) |
| Non-native cover % | **<5** (5-25) |
| Bare Ground % | **30-40** (30-40) |
| Mulch Cover % | <1 |
| KPT | High Conservation Vegetation |
| Was KPT met | **No** |

**Monitoring plot 16** is situated 250 m east of the LLPS in the Murrumbidgee River corridor ACT within former high conservation value natural temperate grassland. Cumulative native cover increased to the 25-50% range. Native sp. remained at **26**. Non-native species decreased from **25** to **22**.

**Noxious species: *Hypericum perforatum* and *Echium vulgare* in low densities. *Marrubium vulgare* was rare.**

**Recommendation: Eliminate noxious species and undertake detailed management of broad-leaved weeds.**

**Plate 2: Monitoring Plot 16 - left spring 2014, right autumn 2015.**

### 4.3.2 Monitoring Plot 15

| Jurisdiction | ACT |
|---|---|
| Native sp. cumulative cover % | **5-25+** (5-25) |
| No. Native sp. with cover score of 1 | **10** (12) |
| No. Native sp. with cover score of 2 or more | **1** (0) |
| Non-native cover % | **25-50** (25-50+) |
| Bare Ground % | **20** (20-30) |
| Mulch Cover % | <5 |
| KPT | High Conservation Vegetation |
| Was KPT met | **No** |

**Monitoring plot 15** is situated 530 m east of the LLPS in the Murrumbidgee River Corridor ACT within former high conservation value natural temperate grassland. Native sp. remained unchanged on **20**. Non-native species declined from **29 to 22**. **Broad-leaf weeds remain dominant.**

**Noxious species: *Echium vulgare* and *Hypericum perforatum* at low density.**

**Recommendation: Eliminate noxious species and undertake detailed management of broad-leaf weeds.**

**Plate 3: Monitoring Plot 15 - left spring 2014, right autumn 2015.**

### 4.3.3 Monitoring Plot 21

| Jurisdiction | ACT |
|---|---|
| Native sp. cumulative cover % | **5-25** (5-25+) |
| No. Native sp. with cover score of 1 | **8** (10) |
| No. Native sp. with cover score of 2 or more | **0** (0) |
| Non-native cover % | **<5** (25-50) |
| Bare Ground % | **20** (10) |
| Mulch Cover % | 20 (<5) |
| KPT | High Conservation Vegetation |
| Was KPT met | **No** |

**Monitoring plot 21** is located 700 m east of the LLPS in the Murrumbidgee River Corridor ACT within former high conservation value natural temperate grassland. Native species decreased from **22 to 12**. Non-native species also decreased from **25 to 13**. **Both noxious and broad-leaf weeds have declined, however, considerable germination of *Hypericum perforatum* was evident.**

**Noxious species: *Echium vulgare* at low densities. *Hypericum perforatum* moderate.**

**Recommendation: Continue with weed control measures and monitor progress.**

**Plate 4: Monitoring Plot 21 - left spring 2014, right autumn 2015.**

### 4.3.4 Monitoring Plot 23

| Jurisdiction | ACT |
|---|---|
| Native sp. cumulative cover % | **25-50- (**5-25+) |
| No. Native sp. with cover score of 1 | **10 (7)** |
| No. Native sp. with cover score of 2 or more | **1** (1) |
| Non-native cover % | **5-25+** (25-50) |
| Bare Ground % | **15** (10) |
| Mulch Cover % | <1 |
| KPT | High Conservation Vegetation |
| Was KPT met | **No** |

**Monitoring plot 23** is situated 1740 m east of the LLPS in the ACT within former high conservation value Box Gum Grassy Woodland. Native species declined from **28** to **24.** Non-native species also declined from **21 to 19**.

**Noxious species: *Hypericum perforatum* at low density**

**Recommendation: Maintain control of noxious species and broad-leaf weeds.**

**Plate 5: Monitoring Plot 23 - left spring 2014, right autumn 2015.**

### 4.3.5 Monitoring Plot 22

| Jurisdiction | ACT |
|---|---|
| Native sp. cumulative cover % | **25-50-** (5-25+) |
| No. Native sp. with cover score of 1 | **9** (10) |
| No. Native sp. with cover score of 2 or more | **2** (0) |
| Non-native cover % | **<5** (25-50) |
| Bare Ground % | **10** (10) |
| Mulch Cover % | <5 |
| KPT | High Conservation Vegetation |
| Was KPT met | **No** |

**Monitoring plot 22** is situated 2150 m east of the LLPS in the ACT within former high conservation value Box Gum Grassy Woodland. Native species declined from **28 to 27**. Non-native species also declined from **20 to 15**.

**Note: Poor quality top-soil.** Increases in cover of *Panicum effusum.*

**Noxious species: *Hypericum perforatum* at low density. Noxious species have declined since previous survey.**

**Recommendation: Maintain control of noxious species and broad-leaf weeds.**

**Plate 6: Monitoring Plot 22 - left spring 2014, right autumn 2015.**

### 4.3.6 Monitoring Plot 24

| Jurisdiction | ACT |
|---|---|
| Native sp. cumulative cover % | **5-25+** (5-25) |
| No. Native sp. with cover score of 1 | **6** (7) |
| No. Native sp. with cover score of 2 or more | **1** (0) |
| Non-native cover % | **5-25-** (5-25) |
| Bare Ground % | **40-50** (50-60) |
| Mulch Cover % | **<1** (1) |
| KPT | High Conservation Vegetation |
| **KPT met** | **No** |

**Monitoring plot 24** is situated 2650 m east of the LLPS on the west side of the Monaro Hwy in the ACT within former high conservation value Box Gum Grassy Woodland. Native species remained at **14**. Non-native species declined from **25 to 13**.

**Poor quality top soil. This section of the corridor has performed poorly.**

**Noxious species: *Eragrostis curvula*, *Hypericum perforatum* and *Nassella trichotoma* at low density**

**Recommendation: Re-seed and undertake detailed management of noxious and broad-leaf weeds. Suggested site for sugar (carbohydrate) trial.**

**Plate 7: Monitoring Plot 24 - left spring 2014, right autumn 2015.**

### 4.3.7 Monitoring Plot 25

| Jurisdiction | NSW |
|---|---|
| Native sp. cumulative cover % | **5-25+** (5-25+) |
| No. Native sp. with cover score of 1 | **8** (8) |
| No. Native sp. with cover score of 2 or more | **1** (0) |
| Non-native cover % | **5-25** (25-50-) |
| Bare Ground % | **5-10** (10) |
| Mulch Cover % | **<5 (mostly grass stems)** |
| KPT | High Conservation Vegetation |
| Was KPT met | **No** |

**Monitoring plot 25** is situated 2800 m east of the LLPS on the east side of the Monaro Hwy in the ACT within former high conservation value Box Gum Grassy Woodland. Native species increased from **15** to **17**. Non-native species declined from **27 to 16**.

**Noxious species: *Hypericum perforatum* and *Eragrostis curvula* at moderate densities and may have increased.**

**Recommendation: Eliminate noxious species. Re-seed, biomass control and undertake detailed management of broad-leaf weeds and pasture grasses. Suggested site for sugar (carbohydrate) trial.**

**Plate 8: Monitoring Plot 25 - left spring 2014, right autumn 2015.**

### 4.3.8 Monitoring Plot 01

| Jurisdiction | NSW |
|---|---|
| Native sp. cumulative cover % | **5-25+** (5-25) |
| No. Native sp. with cover score of 1 | **8** (8) |
| No. Native sp. with cover score of 2 or more | **1** (0) |
| Non-native cover % | **5-25** (5-25+) |
| Bare Ground % | **5-10** (10) |
| Mulch Cover % | Straw **<1**; Woodchip **10** |
| KPT | High Conservation Vegetation |
| Was KPT met | **No** |

**Monitoring plot 01** is situated 3030 m east of the LLPS in NSW (Smith) within former moderate to high conservation value Box Gum Grassy Woodland. Native species declined from **23 to 17**. Non-native species also declined from **22 to 15**.

**Minor improvement in native cover abundance:** notably an increase in the cover of *Panicum effusum*.

**Noxious species: *Eragrostis curvula, Rosa rubiginosa* and *Hypericum perforatum* at low densities.**

**Recommendation: Eliminate noxious species, re-seed and undertake detailed management of noxious weeds e.g. broad-leaf weeds. Possible site for sugar (carbohydrate) trial.**

**Plate 9: Monitoring Plot 01 - left spring 2014, right autumn 2015.**

### 4.3.9 Monitoring Plot 09

| Jurisdiction | NSW |
|---|---|
| Native sp. cumulative cover % | **25-50+** (25-50) |
| No. Native sp. with cover score of 1 | **12** (11) |
| No. Native sp. with cover score of 2 or more | **2*** (2) |
| Non-native cover % | **5-25- (50-75-)**** |
| Bare Ground % | **<5** (<5) |
| Mulch Cover % | <5 (Brome stalks) |
| KPT | High Conservation Vegetation |
| Was KPT met | **No, but in mid-range** |

**Monitoring plot 09** is situated 3600 m east of the LLPS in NSW (McDonald) within former moderate to high conservation value Box Gum Grassy Woodland. Native species declined from **29 to 22**. Non-native species also declined from **17 to 13**.

**Considerable increase in native grasses and seasonal decline** of *Bromus spp.* and *Trifolium* spp. Generally recovery is progressing well.**

**Noxious species: None recorded.**

**Note: This section was pulse grazed in early April 2014**

**Recommendation: Continue pulse grazing and undertake detailed management of broad-leaf weeds.**

**Plate 10: Monitoring Plot 09 - left spring 2014, right autumn 2015. * includes one native species with a cover score of 3 (25-50%).**

### 4.3.10 Monitoring Plot 04

| Jurisdiction | NSW |
|---|---|
| Native sp. cumulative cover % | **25-50+** (25-50) |
| No. Native sp. with cover score of 1 | **7**(10) |
| No. Native sp. with cover score of 2 or more | **4** (2) |
| Non-native cover % | **5-25** (25-50) |
| Bare Ground % | **<5** (<5) |
| Mulch Cover % | 0 |
| KPT | High Conservation Vegetation |
| Was KPT met | **No** |

**Monitoring plot 04** is situated 4025 m east of the LLPS in NSW (McDonald) within former moderate to high conservation value Box Gum Grassy Woodland. Native species declined from **20 to 18**. Non-native species also declined from **21 to 12.**

**Significant seasonal decrease in *Bromus spp.* and *Trifolium* spp.**

**Note: This section was pulse grazed in early April 2014.**

**Noxious species: *Nassella trichotoma* at low density but may be expanding.**

**Recommendation: Eliminate noxious species and continue pulse grazing.**

**Plate 11: Monitoring Plot 04 - left spring 2014, right autumn 2015.**

### 4.3.11 Monitoring Plot 17

| Jurisdiction | NSW |
|---|---|
| Native sp. cumulative cover | **50-75** (50-75-) |
| No. Native sp. with cover score of 1 | **18** (16) |
| No. Native sp. with cover score of 2 or more | **3** (2) |
| Non-native cover % | **5-25-** (5-25) |
| Bare Ground % | **<1** (<5) |
| Mulch Cover % | <5 (grass stalks) |
| KPT | High Conservation Vegetation |
| Was KPT met | **Near** |

**Monitoring plot 17** is situated 7600 m east of the LLPS in NSW (Devitt) within former moderate to high conservation value Box Gum Grassy Woodland. Native species declined from **35 to 34**. Non-native species declined from **21** to **14**.

**Noxious species: *Hypericum perforatum* and *Eragrostis curvula* were not re-recorded.**

**Recommendation: Site requires biomass reduction and detailed management of broad-leaf perennial exotic grasses such as *Plantago lanceolata*, *Paspalum dilatatum* and *Phalaris aquatica*.**

**Plate 12: Monitoring Plot 17 - left spring 2014, right autumn 2015.**

### 4.4 Plots in low-diversity native vegetation (KPT category 2)

Eight plots were established in areas of former low-diversity native vegetation - KPT category 2 (see **Table 1**). Performance targets for category 2 are at present similar to those imposed for category 3 and are provided in Section 2.3, above (Icon Water propose that the current KPT for category 2 be lowered from 70% to 50%). Summaries of category 2 results are provided in **Table 6,** below, with additional descriptions of each plot presented in the succeeding sub-sections.

While no plot in category 2 met the required KPT, all plots obtained native cover scores of 3 (25-50% cover), with six plots improving their native cover score relative to spring 2014.

***Species diversity***

Native species diversity ranged from 13 to 32 species, at an average of 20.7 sp./plot – a decline of 2.3 sp./plot from the previous spring sampling period. Non-native species diversity ranged from 13 to 21 at an average of 16.9 sp./plot - a decline of 5.0 sp. / plot over the same period.

***Individual species cover abundance scores***

The highest cover abundance score for individual native species was 3 (25-50% cover range) obtained by two species: *Bothriochloa macra* (Plot 05) and *Panicum effusum* (Plots 18 and 20), followed by seven species with cover scores of 2 (5-25%), *Rytidosperma* sp. (Plot 19), *Austrostipa scabra* (Plot 03), *Bothriochloa macra* (Plots 03, 06, 10 and 20) *Chloris truncata* (Plot 19), *Microlaena stipoides* (Plot 02 03 and 06), *Panicum effusum* (Plot 19) and *Themeda australis* (Plot 02, 05, 10 and 20). Species with cover scores of 1 (<5% cover & >15 individuals) ranged from a low of 5 up to 14 sp./plot.

The highest individual non-native species cover score was 3 (25-50%) obtained by *Hypochaeris radicata* (Plot 03) and *Plantago lanceolata* (Plots 10). Next highest cover scores were 2 (5-25%) by *Acetosella vulgaris* (Plot 03), *Bromus* sp. (Plot 03), *Cynodon dactylon* (Plot 03), *Hypochaeris radicata* (Plot 02, 05, 06 and 10), followed by scores of 2 (5-25% cover range) for *Avena* sp. (06), *Bromus* sp. (10 and 19), *Hypochaeris radicata* (06 and 10) and *Plantago lanceolata* (Plot 20). Species with cover scores of 1 ranged from a low of 3 up to 10 sp./plot.

***Cumulative cover abundance scores***

Cumulative native cover increased in seven plots and remained stable in one plot (**Table 6**). *Overall there was an increase in total native species cover in this category (which now sits at the mid to upper level of the 25-50% range) compared to the previous sampling period*. While this is an encouraging result it is doubtful that this trend would continue uninterrupted and reaching the 70% KPT will be difficult.

Cumulative non-native cover declined in five plots and remained stable in two plots and increased in one (**Table 5**). *Overall, there was a reduction in total non-native species cover in this category.*

**Table 6: Summary of category 2 plot results for the current autumn 2015 survey. Table provides plot data on: current species richness and changes from spring 2014; native species with cover scores of 1 or more; and cumulative cover abundance estimates for native and exotic species.**

**Parentheses ( ) enclose results from spring 2014 and red text identifies an increase, blue a decrease and black no change.**

| Plot No. | Chainage | Location | Native sp. | Exotic sp. | Total sp. | Change native sp.* | Change exotic sp. * | Native sp. cover score of 1 | Native sp. cover score of 2 or > | Total native cover % | Total exotic cover % |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **19** | 1020 | ACT | **13** | **15** | **28** | 3 (-2) | 12 (5) | 5 (8) | 3 (1) | 25-50- | <5 |
| **20** | 1200 | ACT | **32** | **14** | **46** | 4 (2) | 8 (-4) | 13 (12) | 3[A] (1) | 25-50+ | 5-25+ |
| **18** | 1450 | ACT | **23** | **20** | **43** | 2 (3) | 3 (-3) | 11 (12) | 1[A] (0) | 25-50+ | 5-25+ |
| **02** | 3220 | NSW-Smith | **27** | **13** | **40** | 3 (9) | 8 (12) | 10 (8) | 2 (1) | 25-50- | **5-25** |
| **03[P]** | 3320 | NSW-McDonald | **15** | **18** | **33** | 1 (0) | 4 (6) | 9 (10) | 3 (1) | 25-50 | **25-50+** |
| **05 [P]** | 4300 | NSW-McDonald | **21** | **21** | **42** | 6 (-3) | 3 (8) | **14** (14) | 2[A] (0) | 25-50+ | 25-50- |
| **06** | 4900 | NSW-Lonergan | **16** | **21** | **37** | 1 (-5) | 3 (-2) | 8 (7) | 2 (1) | 25-50- | 5-25+ |
| **10** | 6030 | NSW-Codd / Howarth | **19** | **13** | **33** | **0** (-3) | 5 (-4) | 10 (7) | **2** (2) | **25-50-** | 25-50+ |
| **Av autumn 2015** | | | **20.7** | **16.9** | **37.6** | | | | | 25-50+ | 5-25+ |
| Av spring 2014 | | | 23.0 | 21.9 | 39.9 | | | | | 25-50- | 25-50+ |
| Av autumn 2014 | | | 23.6 | 19.6 | 38.4 | | | | | 25-50 | 25-50- |
| Av spring 2013 | | | 25.7 | 25.2 | 50.9 | | | | | | |
| Av. autumn 2013 | | | 20.9 | 23.9 | 44.8 | | | | | | |
| Av. spring 2012 | | | 19.8 | 26.6 | 46.3 | | | | | | |
| Av. autumn 2012 | | | 19.7 | 19.6 | 39.2 | | | | | | |

* Change in species richness in the period between spring 2014 and autumn 2015.

[P] Pulse grazed prior to autumn 2014 sampling. (Note: Plot 03 is divided by fencing and only half the plot was grazed).

+ Total cover estimated at the upper end of range

- Total cover estimated at the lower end of range

[A] = includes species with cover score of 3 (25-50%)

### 4.4.1 Monitoring Plot 19

| Jurisdiction | NSW |
|---|---|
| Native sp. cumulative cover % | **25-50-** (5-25+) |
| No. Native sp. with cover score of 1 | **5** (8) |
| No. Native sp. with cover score of 2 or more | **3** (1) |
| Non-native cover % | **<5** (5-25+) |
| Bare Ground % | **30** (30-40) |
| Mulch Cover % | 5% |
| KPT | Low diversity native vegetation |
| Was KPT met | **No (mid range)** |

**Monitoring plot 19** is situated 1020 m east of the LLPS in the ACT within former low diversity Box Gum Grassy Woodland. Native species declined from **16 to 13**. Non-native species decreased from **27 to 15.**

The increase in cover was attributed to *Panicum effusum* and *Chloris truncata*.

**Noxious species: *Hypericum perforatum* occurs at low density. Recommendation: Eliminate noxious species and undertake detailed management of broad-leaf weeds.**

**Plate 13: Monitoring Plot 19 - left spring 2014, right autumn 2015.**

### 4.4.2 Monitoring Plot 20

| Jurisdiction | ACT |
|---|---|
| Native sp. cumulative cover % | **25-50+** (25-50-) |
| No. Native sp. with cover score of 1 | **13** (12) |
| No. Native sp. with cover score of 2 or more | **3** (1) |
| Non-native cover % | **5-25+** (50-75) |
| Bare Ground % | **<1** (<1) |
| Mulch Cover % | None applied (<5% grass stems) |
| KPT | Low diversity native vegetation |
| Was KPT met | **No (mid range)** |

**Monitoring plot 20** is situated 1200 m east of the LLPS in the ACT within former low diversity Box Gum Grassy Woodland. The plot retains a small component of the original vegetation along the N boundary. Native species declined from **36 to 32**. Non-native species declined from **22 to 14.**

Seasonal decline of *Bromus* spp., and *Trifolium* spp. and a substantial increase in the cover of *Panicum effusum*.

**Noxious species: *Eragrostis curvula* and *Carthamus lanatus* at low densities.**

**Recommendation: Eliminate noxious species and undertake detailed management of broad-leaf weeds.**

**Plate 14: Monitoring Plot 20 left spring 2014, right autumn 2015.**

### 4.4.3 Monitoring Plot 18

| Jurisdiction | ACT |
|---|---|
| Native sp. cumulative cover % | **25-50+** (25-50-) |
| No. Native sp. with cover score of 1 | **11** (12) |
| No. Native sp. with cover score of 2 or more | **1** (0) |
| Non-native cover % | **50-75** (25-50+) |
| Bare Ground % | **<5** (<5) |
| Mulch Cover % | **<5 (grass stems)** (<1) |
| KPT | Low diversity native vegetation |
| Was KPT met | **No (mid range)** |

**Monitoring plot 18** is situated 1450 m east of the LLPS in the ACT within former low diversity Box Gum Grassy Woodland. Trees/shrubs have been planted within the plot. Native species declined from **25** to **23**. Non-native species declined from **23** to **20.**

Seasonal decline of *Bromus* spp., and *Trifolium* spp. and a substantial increase in the cover of *Panicum effusum*.

**Noxious species: *Hypericum perforatum* occurred at low densities. *Eragrostis curvula* was not re-recorded.**

**Recommendation: Eliminate noxious species and undertake detailed management of broad-leaf weeds.**

**Plate 15: Monitoring Plot 18 - left spring 2014, right autumn 2015.**

### 4.4.4 Monitoring Plot 02

| Jurisdiction | NSW |
|---|---|
| Native sp. cumulative cover % | **25-50-** (5-25+) |
| No. Native sp. with cover score of 1 | **10** (8) |
| No. Native sp. with cover score of 2 or more | **2** (1) |
| Non-native cover % | **5-25** (5-25) |
| Bare Ground % | **15-20** (20-30) |
| Mulch Cover % | **<5 (grass stems)** (<1) |
| KPT | Low diversity native vegetation |
| Was KPT met | **No (mid range)** |

**Monitoring plot 02** is situated 3220 m east of the LLPS in NSW (Smith) within former Brittle Gum / Broadleaf Peppermint Dry Woodland. Native species declined from **30 to 27**. Non-native species declined from **21 to 13**.

**Noxious species: *Eragrostis curvula*, *Hypericum perforatum* and *Rosa rubiginosa* at low densities.**

**Recommendation: Eliminated noxious species and undertake detailed management of broad-leaf weeds.**

**Plate 16: Monitoring Plot 02 – left spring 2014, right autumn 2015.**

### 4.4.5 Monitoring Plot 03

| Jurisdiction | NSW |
|---|---|
| Native sp. cumulative cover % | **25-50** (5-25+) |
| No. Native sp. with cover score of 1 | **9** (10) |
| No. Native sp. with cover score of 2 or more | **2** (0) |
| Non-native cover % | **25-50+** (25-50+) |
| Bare Ground % | **<1** (<1) |
| Mulch Cover % | **10 - grass stems** (0) |
| KPT | Low diversity native vegetation |
| Was KPT met | **No (Mid range)** |

**Monitoring plot 03** is situated 3320 m east of the LLPS in NSW (McDonald) within low diversity pasture at the interface of Brittle Gum / Broadleaf Peppermint Woodland and Box Gum Grassy Woodland. Native species declined from **16 to 15**. Non-native species declined from **21 to 18. Note: seasonal decline of *Bromus* spp. and *Trifolium spp.*. *Hypochaeris radicata* maintained high cover.**

**Noxious species: *Echium plantagineum* and *Eragrostis curvula* were recorded at low densities. The later was scattered throughout corridor to the west of Plot 03.**

**Recommendation: Eliminate noxious species, maintain pulse grazing and undertake detailed management of broad-leaf weeds.**

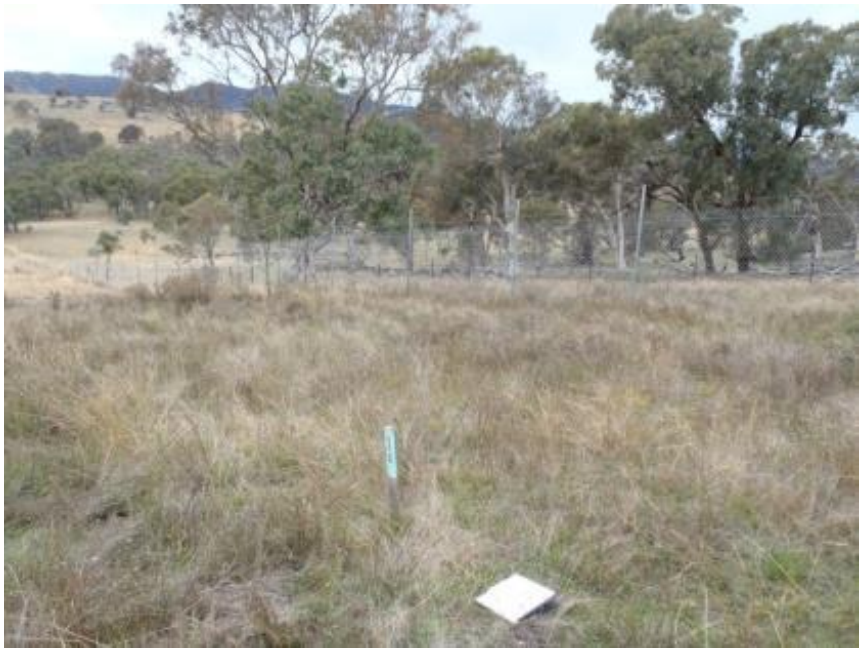


**Plate 17: Monitoring Plot 03 - left spring 2014, right autumn 2015.**

### 4.4.6 Monitoring Plot 05

| Jurisdiction | NSW |
|---|---|
| Native sp. cumulative cover % | **25-50+** (25-50-) |
| No. Native sp. with cover score of 1 | **14** (14) |
| No. Native sp. with cover score of 2 or more | **2** (0) |
| Non-native cover % | **25-50-** (50-75) |
| Bare Ground % | **<1** (<5) |
| Mulch Cover % | **<1 - grass stems** |
| KPT | Low diversity native vegetation |
| Was KPT met | **No (mid range)** |

**Monitoring plot 05** is situated 4300 m east of the LLPS in NSW (McDonald) within former low diversity Box Gum Grassy Woodland. Native species declined **27 to 21**. Non-native species increased from **24 to 21**.

**Seasonal decline of *Bromus* spp. and *Trifolium* spp., slight increase of *Hypochaeris radicata*.**

**Noxious species: none observed**

**Recommendation: Undertake detailed management of broad-leaf weeds. Continue and expand pulse grazing in this portion of the corridor.**

**Plate 18: Monitoring Plot 05 - left spring 2014, right autumn 2015.**

### 4.4.7 Monitoring Plot 06

| Jurisdiction | NSW |
|---|---|
| Native sp. cumulative cover % | **25-50-** (5-25+) |
| No. Native sp. with cover score of 1 | **8** (7) |
| No. Native sp. with cover score of 2 or more | **2** (1) |
| Non-native cover % | **5-25+** (25-50+) |
| Bare Ground % | **<5** (<5) |
| Mulch Cover % | **5 - grass stems** (<5) |
| KPT | Low diversity native vegetation |
| Was KPT met | **No (mid range)** |

**Monitoring plot 06** is situated 4900 m east of the LLPS in NSW (Lonergan) within former low diversity Box Gum Grassy Woodland. Native species increased from **15 to 16**. Non-native species increased from **18 to 21.**

**Seasonal decline of *Bromus* spp.**

**Noxious species: *Carthamus lanatus* at moderate density. *Eragrostis curvula* near Valve 5007 to east.**

**Recommendation: Eliminate noxious species, undertake detailed management of broad-leaf weeds and reduce biomass preferably through grazing.**

**Plate 19: Monitoring Plot 06 - left spring 2014, right autumn 2015.**

### 4.4.8 Monitoring Plot 10

| Jurisdiction | NSW |
|---|---|
| Native sp. cumulative cover % | **25-50-** (25-50-) |
| No. Native sp. with cover score of 1 | **10** (7) |
| No. Native sp. with cover score of 2 or more | **2** (2) |
| Non-native cumulative cover % | **25-50+** (5-25) |
| Bare Ground % | **<5** (<5) |
| Mulch Cover % | <1 (<5) |
| KPT | Low diversity native vegetation (mixed pasture) |
| Was KPT met | **No, but in mid range** |

**Monitoring plot 10** is situated 6030 m east of the LLPS in NSW (Codd/Howarth) within former low diversity mixed pasture. Native species remained on **19.** Non-native species declined from **18 to 13.**

**Seasonal decline of *Bromus spp*., and *Trifolium spp. Hypochaeris radicata,* and *Plantago lanceolata* have maintained high cover.**

**Noxious species: none observed**

**Recommendation: Consider biomass control and undertake detailed management of broad-leaf weeds.**

**Plate 20: Monitoring Plot 10 - left spring 2014, right autumn 2015.**

### 4.5 Plots in non-native vegetation (KPT category 1)

Six plots were established in areas of former non-native vegetation or low diversity mixed pasture – KPT category 1 (see **Table 1**). All plots in this category were located in the NSW section of the construction corridor (**Figures 2** and **3 in Appendix 1**).

The results from category 1 plots are provided in **Table 7**, below, with additional descriptions of each plot presented in the succeeding sub-sections.

Plots 13 (Borgia), 14 (Johnston), 11 (Johanson) and more recently 07 and 08 (Lonergan) met the required KPT and paddocks associated with these plots have been returned to property owners. Plot 12 (Bos) has consistently scored in the mid to high end of the 50-75% cover range and is considered to have met the required KPT.

***Species diversity***

Only one plot remained in this category, which contained 10 native species and 25 non-native species.

***Individual species cover abundance scores***

The highest cover abundance score for an individual native herbaceous species was 1 (<5%), which was obtained by three species.

The highest cover abundance score for non-native herbaceous species was 4 (50-75% cover) obtained by *Dactylis glomerata.* Eight non-native species had individual cover scores of 1 (<5%).

***Cumulative cover abundance scores***

Total cover abundance for Plot 12 fell in the mid to high end of the 50-75% cover range and is consistent with the results of the previous three monitoring periods for this plot (**Table 7**).

Total native species cover score was <5%.

All plots in category 1 have now met the required KPT and no longer require monitoring.

**Table 7: Summary of category 1 plot results for the current autumn 2015 survey. Table provides data on: current species richness per plot and changes from spring 2014; non-native species cover scores (1 = <5%, 2 = 5-25%), 3 = 25-50%) and 4 = 50-75%); and cumulative cover abundance estimates for native and exotic species.**

**Parenthesis ( ) enclose results from autumn 2014 and red text identifies an increase, blue a decrease and black no change.**

| Plot No. | Chainage | Location | Native sp. | Exotic sp. | Total sp. | Change native sp.* | Change exotic sp. * | Exotic sp. cover score of 1 | Exotic sp. cover score of 2 | Exotic sp. cover score of 3 or > | Total native cover % | Total exotic cover % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **07** [A] | 5200 | NSW-Lonergan | - | - | - | - | - | - | - | - | - | - |
| **08** | 5680 | NSW-Lonergan | - | - | - | - | - | - | - | - | - | - |
| **11** | 6450 | NSW-Johanson | - | - | - | - | - | - | - | - | - | - |
| **12** | 8300 | NSW-Bos | **10** | **25** | **35** | 1 (-1) | 4 (-5) | 7 (8) | 1 (2) | 1[B] (1) | **<5** | **50-75+** |
| **14** | 9850 | NSW-Johnston | - | - | - | - | - | - | - | - | - | - |
| **13** | 10950 | NSW-Borgia | - | - | - | - | - | - | - | - | - | - |
| Av autumn 2015 | | | 10 | 25 | 35 | | | | | | | |
| Av spring 2014 | | | 13.3 | 26.7 | 40.0 | | | | | | | |
| Av autumn 2014 | | | 14.7 | 21.7 | 36.3 | | | | | | | |
| Av spring 2013 | | | 8.7 | 16 | 24.7 | | | | | | | |
| Av. autumn 2013 | | | 7.3 | 14 | 21.3 | | | | | | | |
| Av. spring 2012 | | | 6.8 | 21.4 | 28.2 | | | | | | | |
| Av. autumn 2012 | | | 6.2 | 20.8 | 28.6 | | | | | | | |

* Represents change in native and non-native species diversity between the autumn 2014 and spring 2014 monitoring period.

[A] Paddock sown with native / non-native seed mix. Plot 07 was incorporated into category 1 in autumn 2014.

[B] Includes one species with a cover score of 4 (50-75%).

### 4.5.1 Monitoring Plot 12

| Jurisdiction | NSW |
|---|---|
| Exotic sp. cumulative cover % | **50-75** (50-75) |
| No. Exotic sp. with cover score of 1 | **7** (8) |
| No. Exotic sp. with cover score of 2 or more | **2* (3**)** |
| Native cover % | **<5** (5-25) |
| Bare Ground % | **5-10** (5-10) |
| Mulch Cover % | **<5%-grass stems** (0) |
| KPT | Non-native vegetation |
| Was KPT met | **YES** |

**Monitoring plot 12** is situated 8300 m east of the LLPS in NSW (Bos) within former low diversity mixed pasture.

Native species declined from **11 to 10.** Non-native species declined from **29 to 25.**

**Noxious species: *Echium plantagineum* at low densities and *Eragrostis curvula* at moderate density.**

*** cover score of 4-, ** includes one sp. with cover score of 3**

**Plot 12 met the KPT during the current survey will no longer be monitored.**

**Plate 21: Monitoring Plot 12 - left spring 2014, right autumn 2015.**

### 4.6 Rare and threatened plants

No new observations were recorded during the spring 2014 survey period.

### 4.7 Rare and threatened animals

*Birds*

*Stagonopleura guttata* (Diamond Firetail), *Petroica boodang* (Scarlet Robin) and *Climacteris picumnus* (Brown Treecreeper) were observed in scattered woodland near the eastern boundary of the McDonald property on 21 April 2015. The woodland extends along the eastern boundary of the McDonald property overlapping the adjoining Lonergan property and connects with woodland to the north, south and south-west. Habitat features in this woodland include: a mature tree canopy, variable tree age classes; tree hollows; fallen timber also with hollows and a predominately native ground cover.

Brown Treecreepers have been observed foraging and engaging in nesting activity at this location on three separate occasions between spring 2013 and autumn 2015 and there are strong indicators that this is an established breeding group.

Diamond Firetails have also been observed at the same location on a number of occasions since 2009, with the most recent sighting accounting for up to 20 individuals in a mixed feeding flock of Yellow-rumped Thornbill *Acanthiza chrysorrhoa*, Superb-blue Wren *Malurus cyaneus* and a pair of Scarlet Robin.

*Invertebrates*

Eight individual *Keyacris scurra* (Keys Matchstick Grasshopper) comprising one green and seven brown morphological forms were observed at Control Site 2 on 20 April 2015.

### 4.8 Other observations

Two species of native plant not previously recorded within the construction corridor - *Cullen microcephalum* (Mountain Psoralea) and *Veronica gracilis* (Slender Speedwell) - were recorded in Plot 17.

There was a significant (though not unexpected) decline in the cover abundance of some annual pasture grasses (mainly *Brome* spp. and *Vulpia* sp.) and clover *Trifolium* spp., which resulted in a greater net reduction in exotic species cover than in previous survey sessions.

### 4.9 Noxious weeds

Nine species of noxious plant have been recorded within or adjacent to sample plots (**Table 8**), of these eight were re-recorded during the current survey: they are: *Carthamus lanatus* (Saffron Thistle), *Echium plantagineum* (Paterson's Curse), *Echium vulgare* (Viper's Bugloss), *Eragrostis curvula* (African Love Grass), *Hypericum perforatum* (St. John's Wort), *Marrubium vulgare* (Horehound), *Nassella trichotoma* (Serrated Tussock) and *Rosa rubiginosa* (Briar Rose).

*Rubus* spp. (Blackberry) was not re-recorded within sample plots although it was recorded in Control Plot 1 and may occur elsewhere within the construction corridor.

The infestation of *Eragrostis curvula* on the western side of the Monaro Highway south of the main access gate has been largely controlled, however, the species has become widespread within some

sections of the corridor, particularly in the area between the Monaro Highway corridor and Value 3279, and immediate action will be required to contain its dispersal.

**Table 8: Noxious weeds recorded within the construction corridor.**

| Noxious Species | Declared in NSW | Declared in ACT | WONS | Plot / Location | Estimated density. |
|---|---|---|---|---|---|
| *Carthamus lanatus* (Saffron Thistle) | Yes | Yes | | 01 | Not re-recorded |
| | | | | 03 | Not re-recorded |
| | | | | 06 | >15 individuals |
| | | | | 07 | Not re-recorded |
| | | | | 18 | Not re-recorded |
| | | | | 19 | Not re-recorded |
| | | | | 20 | <4 individuals ^ |
| *Echium plantagineum* (Paterson's Curse) | Yes | Yes | | 10 | Not re-recorded |
| | | | | 11 | Not re-recorded |
| | | | | 12 | <4 individuals |
| *Echium vulgare* (Viper's Bugloss) | Yes | Yes | | 12 | Not re-recorded |
| | | | | 15 | >15 individuals |
| | | | | 16 | <4 individuals |
| | | | | 19 | Not re-recorded |
| | | | | 20 | Not re-recorded |
| | | | | 21 | >15 individuals |
| | | | | 23 | Not re-recorded |
| | | | | 24 | Not re-recorded |
| | | | | 25 | <4 individuals |
| *Eragrostis curvula* (African Love Grass) | Yes | Yes | | 01* | <4 individuals v |
| | | | | 02* | <4 individuals ^ |
| | | | | 06* | Not re-recorded |
| | | | | 12 | >15 individuals |
| | | | | 17 | Not re-recorded |
| | | | | 18 | Not re-recorded |
| | | | | 19 | Not re-recorded |
| | | | | 22 | Not re-recorded |
| | | | | 24 | <4 individuals |
| | | | | 25* | >15 individuals ^ |
| | | | | Either side of Angle Crossing Rd. near cattle grid | 50+ individuals |
| | | | | Nth of construction corridor b/w Monaro Hwy and Railway corridor | +1000 of individuals |
| | | | | S. of Plot 24 | <20 individual plants v |
| | | | | Low numbers though widespread east of plot 24 to Valve 3279 | unknown |
| *Hypericum perforatum* (St. John's Wort) | Yes | Yes | | 01 | 4-15 individuals |
| | | | | 02 | 4-15 individuals ^ |
| | | | | 10 | Not re-recorded |

| Noxious Species | Declared in NSW | Declared in ACT | WONS | Plot / Location | Estimated density. |
|---|---|---|---|---|---|
| | | | | 12 | Not re-recorded |
| | | | | 15 | >15 individuals ^ |
| | | | | 16 | >15 individuals ^ |
| | | | | 17 | Not re-recorded |
| | | | | 18 | 4-15 individuals |
| | | | | 19 | 4-15 individuals |
| | | | | 20 | Not re-recorded |
| | | | | 21 | >15 individuals |
| | | | | 22 | <4 individuals V |
| | | | | 23 | <4 individuals V |
| | | | | 24 | 4-15 individuals |
| | | | | 25* | >15 individuals |
| *Marrubium vulgare* (Horehound) | Yes | No | | 06 | Not re-recorded |
| | | | | E. of Plot 07 | Not re-recorded |
| | | | | 16 | <4 individuals ^ |
| *Nassella trichotoma* (Serrated Tussock) | Yes | Yes | Yes | 04 | 4 -15 individuals |
| | | | | 24 | <4 individuals ^ |
| | | | | 25 | <4 individuals ^ |
| *Rosa rubiginosa* (Briar Rose) | Yes | Yes | | 01 | <4 individuals V |
| | | | | 02 | <4 individuals |
| | | | | 05 | Not re-recorded |
| | | | | 18 | Not re-recorded |
| | | | | 22 | Not re-recorded |
| | | | | 23 | Not re-recorded |
| *Rubus* sp. (Blackberry) | Yes | Yes | Yes | 18 | Not re-recorded |

^ = increasing; V = decreasing
* = also recorded in low numbers within adjacent sections of the construction corridor.
WONS = Weed of National Significance, see
<http://www.environment.gov.au/biodiversity/invasive/weeds/weeds/lists/wons.html>

# 5 Management issues

## 5.1 Weeds

Weed control measures appear to have been implemented (in accordance with the Weed Management Sub-plan) in problem areas previously identified. While some infestations have declined others persist (**Table 8**).

A variety of relatively small exotic herbs recorded within the construction corridor have minor limiting effects on the germination and survival of native herbaceous species and therefore do not require any specific management action. Species in this group include annual grasses such as *Vulpia* sp., *Aira* sp., *Briza* spp. and *Bromus* spp., and small annual herbs such as *Linaria* spp., *Centaurium* sp., *Erodium botrys*, *Juncus bufonius*, *Spergularia rubra*, *Trifolium arvense*, *T. anguistifolium* and *Galium divaricatum*.

In contrast, exotic perennial pasture grasses, perennial clovers and broad-leaf weeds are imposing significant limitations on the recruitment and vigour of native herbaceous groundcovers in some sections of the construction corridor. Species of greatest concern are perennial grasses such as *Dactylis glomerata*, *Paspalum dilatatum*, *Phalaris aquatica*, *Lolium perenne and Bromus catharticus* (initial perennial forms are replaced by annual or short-lived perennial forms), perennial clovers such as *Trifolium repens* and a variety of broad-leaf weeds including *Conyza* sp., *Echium* spp., *Hypochaeris radicata*, *Verbena bonariensis, Hirschfeldia incana, Plantago lanceolata, Cirsium vulgare* and *Acetosella vulgaris*.

The following measures are recommended in addition to works required under the weed management sub-plan:

- Continue chemical weed control though care should be taken to minimise the impact on non-target species. However, in situations where infestations of broad-leaf weeds are confined to small areas or where they occur in low densities plants should be extracted by hand (grubbing or hoeing may also be acceptable) bagged and disposed of appropriately.
- Engage with ACT Government (Territory and Municipal Services) to reduce significant *Eragrostis curvula* infestations within the Monaro Hwy and Goulburn-Cooma railway corridors.

## 5.2 Biomass and weed control

If approved, pulse grazing should be repeated within the central section (NSW) of the construction corridor in late winter 2015 and again during late summer early autumn 2016. An inspection should be conducted prior to grazing to ascertain the degree and type of cover so that the maximum benefit can be gained from short-term grazing.

Difficulties associated with managing stock in the ACT section of the corridor have been identified and prohibits the use of grazing as a method of biomass and weed control. Previous suggestions regarding a carbohydrate (sugar) supplement trial should therefore be considered.

## 5.3 Poor quality top-soil

*Refer to comments in the spring 2013 plot monitoring report.*

### 5.4 Bare ground

*Refer to comments in the spring 2013 plot monitoring report.*

### 5.5 Re-seeding

Re-seeding was undertaken by Greening Australia within the western parts of the construction corridor, between Angle Crossing Road and Plot 19.

### 5.6 KPTs

Difficulties associated with achieving KPTs were raised in Section 5.5 of the spring 2014 plot monitoring report, which recommended a review of the KPTs.

Despite recent improvements in native vegetation cover it remains unlikely that the current KPT of 70% would be achieved in the short to medium term. Furthermore, in order to reach this target it is likely that increased efforts in biomass and weed control and re-seeding would be required.

# 6 Recommendations

The following actions and recommendations have been proposed in earlier reports.

1. Persist with chemical weed control but ensure that it is specifically targeted and minimises any impact to non-target species (see Section 5.1).
2. Pulse grazing should be repeated in the central section of the construction corridor in late winter (late August, 2015) and again during the following summer/autumn period. Biomass control should also be considered in other sections of the construction corridor, i.e. Plots 06 and 17 in NSW and the western section of the ACT between Angle Crossing Road and the power transmission easement to the east of Plot 23.
3. The current 70% KPT for both categories 2 and 3 vegetation should be reconsidered. Despite the recent improvement in native cover abundance it is acknowledged that this target will be difficult to achieve in the short to medium term and it is recommended that the KPTs be lowered to 50% and 60%, respectively (with the condition that Icon commit to all management obligations until these targets are met). *Note: The suggested targets are not inconsistent with former native vegetation cover as were measured in the NSW sections during the pre-construction impact assessment phase of the project* (Biosis Research, June 2009).
4. Consider undertaking a trial application of carbohydrate (sugar) in the ACT sections of the construction corridor where native germination and propagation has been particularly poor and non-native pasture grasses and broad-leaf weeds are well established and/or dominant.

# 7 Conclusion

Plot 12 (category 1) has maintained a cover score at the high end of the 50-75% range and is considered to have met the KPT. This brings the total number of plots that have reached the required target to six, all of which are associated with non-native vegetation (category 1). Plot 17 (native vegetation category 3) has consistently achieved cumulative native cover score in the low to mid level of the 50-75% range and remains near the required KPT.

Although no plot associated with native vegetation (categories 2 and 3) has yet achieved the required KPT five plots attained native cover scores at the higher end of the 25-50% range, with another eight plots scoring in the mid to lower levels of the same range. In all, fifteen plots exhibited elevated native cover scores, which amounted to an estimated total increase of 10 to 15% increase compared to the previous spring survey and is a substantial improvement on previous results. The challenge will be to maintain these levels of native cover and contend with the re-emergence of annual exotic herbs in the coming seasons.

A number of recommendations have been presented regarding the control broad-leaf weeds and total foliage cover, particularly in the central and western sections of the construction corridor. Pulse grazing was undertaken successfully in the central sections in late March/early April 2014 and it is recommended that a similar approach be repeated in late winter 2015 and again during the following summer/autumn period. Consideration should be given to adopting this approach in other secure sections of the construction corridor where biomass reduction and weed management are desired. Finally, consideration should be given to lowering the KPTs for vegetation categories 2 and 3 to 60% and 50%, respectively.

# References

Biosis Research (June 2009). *Murrumbidgee River to Googong Dam Water Transfer Pipeline: Terrestrial Flora & Fauna Impact Assessment*. Biosis Research Pty Ltd, Queanbeyan NSW.

Eco Logical Australia (November 2010). *Murrumbidgee to Googong Pipeline: Pre-clearance Surveys.* Prepared for Bulk Water Alliance Joint Venture.

Eco Logical Australia (March 2011). *M2G Rapid Vegetation Assessment of the Hard Rock Re-alignment Route*. Prepared for Bulk Water Alliance Joint Venture.

Eco Logical Australia & Blue Gum Ecological Consulting (August 2013). *M2G Seeding (Plot) Monitoring Report. Construction Corridor (Autumn 2013)*. Prepared for ACTEW Water.

Landscape Rehabilitation and Terrestrial Ecology Management Plan (2014). ACTEW Corporation, Canberra.

M2G Work as Executed (WAE) Landscape Drawings.

# Appendix 1: Maps

**Figures 1 – 4, below,** display the locations of the plot monitoring sites within the M2G construction corridor:

- **Figure 1**: Western section
- **Figure 2**: Central-western section
- **Figure 3**: Central-eastern section
- **Figure 4**: Eastern section


**Figure 1: Monitoring sites within the western section of the M2G construction corridor**


**Figure 2: Monitoring sites within the central-western section of the M2G construction corridor**

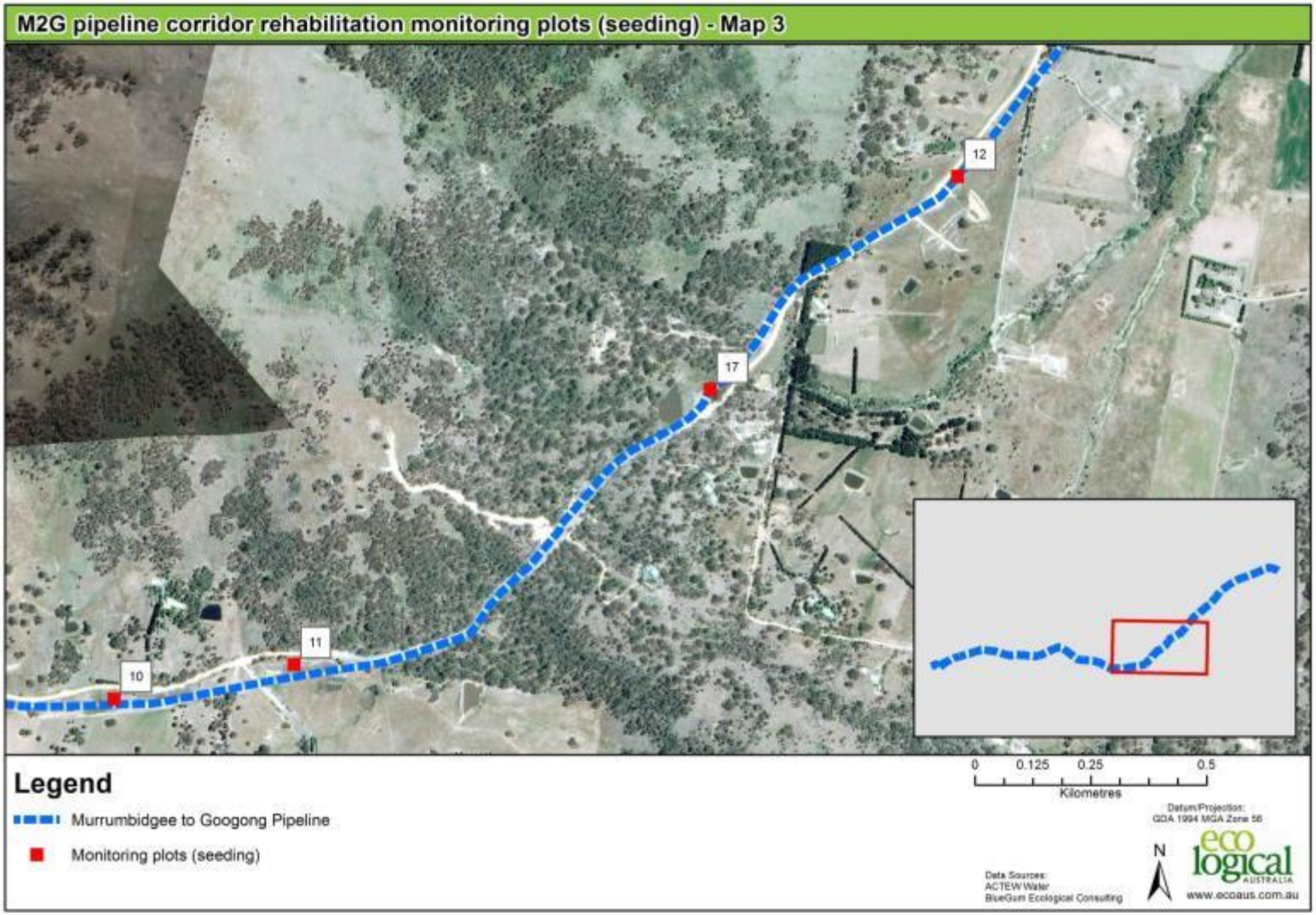



**Figure 3: Monitoring sites within the central-eastern section of the M2G construction corridor**

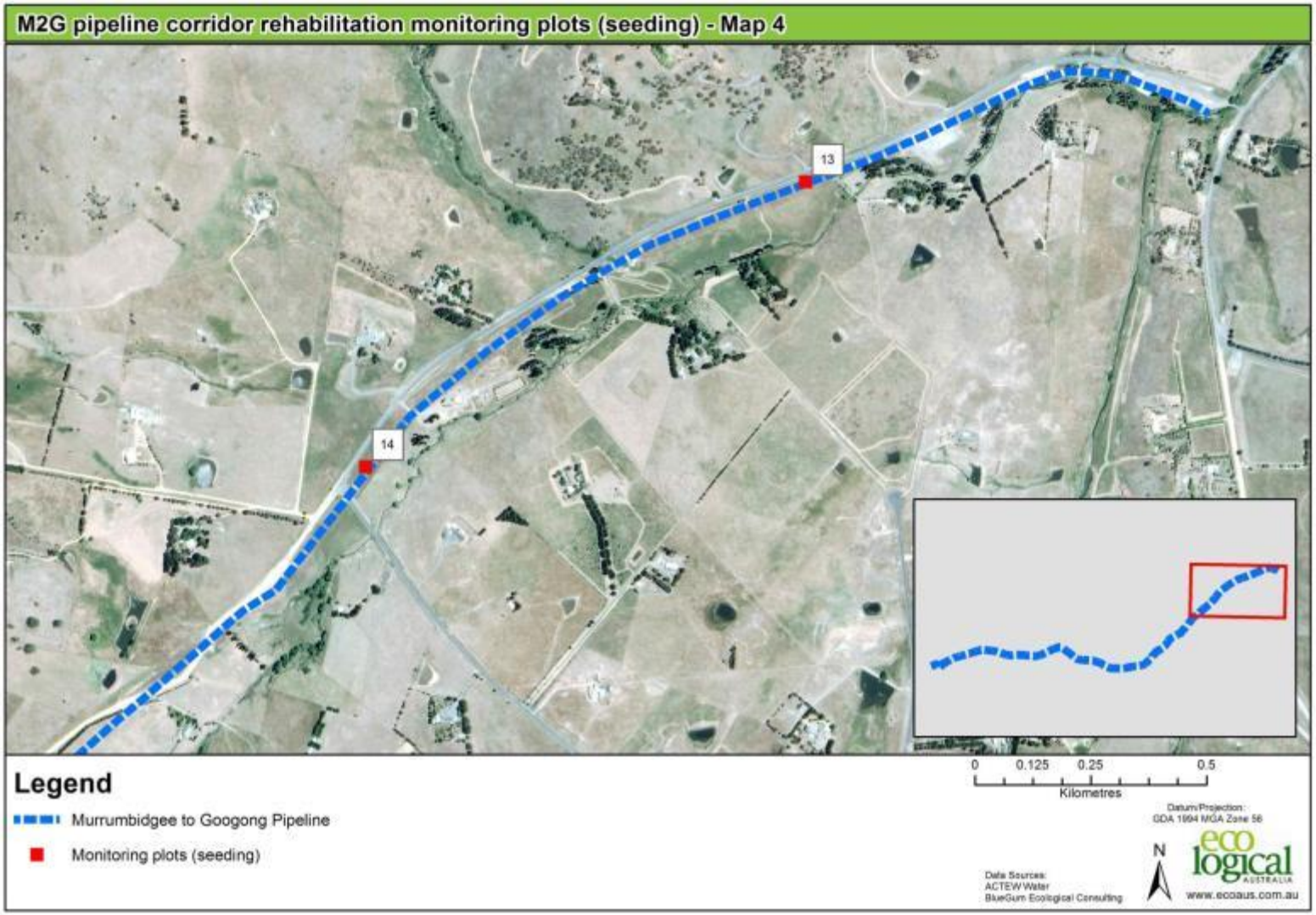



**Figure 4: Monitoring sites within the eastern section of the M2G construction corridor**

# Appendix 2: Plot floristic data

Plot data for the M2G plot (seeding) monitoring study for spring 2014. Data sets for control plots and monitoring plots are provide in Table 7 and Table 8, respectively.

The tables give estimated species cover abundance according to the modified Braun-Blanquet scale below. Species are listed alphabetically and have been separated into native and non-native groups.

Recruiting eucalypt and other woody shrubs are included in the species lists below, but were not considered in the analysis of cover abundance or species tallies.

Modified Braun-Blanquet cover abundance scores

- r = < 5% cover and solitary (< 4 individuals)
- + = < 5% cover and few (4-15 individuals)
- 1 = < 5% cover and numerous/scattered (>15 individuals)
- 2 = 5% – 25% cover
- 3 = 25% – 50% cover
- 4 = 50% – 75% cover
- 5 = > 75% cover

**Table 9: Floristic data: Control plot autumn 2015.**

*According to Rehwinkel (2007) indicator species are referred to as 'grazing intolerant' or 'declining' species. An indicator species score of '1' identifies a site as having conservation value and indicator species score of '2' are highly significant and are given the highest value. The more of these species present at a site the greater its conservation value. *Themeda australis* is treated as a level 2 indicator species when dominant, as is the case at Control Site 2.

| Species | Sp. cover score | Sp. with cover score of 1 | Sp. with cover score of 2 | Sp. with cover score of 3 | Sp. with cover score of 4 | Indicator score* |
|---|---|---|---|---|---|---|
| **CONTROL PLOT 1** | | | | | | |
| **Exotic** | | | | | | |
| *Acetosella vulgaris** | + | | | | | |
| *Eragrostis curvula** | + | | | | | |
| *Gamochaeta sp.** | r | | | | | |
| *Hypericum perforatum** | + | | | | | |
| *Hypochaeris radicata** | 1 | 1 | | | | |
| *Lolium perenne** | r | | | | | |
| *Paronychia brasiliana** | + | | | | | |
| *Rosa rubiginosa** | r | | | | | |
| *Rubus sp.** | r | | | | | |
| *Taraxacum officinale** | r | | | | | |
| *Trifolium arvense** | 1 | 1 | | | | |
| *Trifolium sp.** | 1 | 1 | | | | |
| *Vulpia sp.** | 1 | 1 | | | | |
| **Total exotic species** | **13** | **4** | | | | |
| **Cumulative cover** | **1 (<5%)** | | | | | |
| **Native** | | | | | | |
| *Acaena sp.* | r | | | | | |
| *Aristida ramosa* | r | | | | | |
| *Arthropodium milleflorum* | r | | | | | *2* |
| *Austrodanthonia sp.* | *3* | | | 1 | | |
| *Austrostipa bigeniculata* | 1 | 1 | | | | |
| *Austrostipa scabra* | 1 | 1 | | | | |

| Species | Sp. cover score | Sp. with cover score of 1 | Sp. with cover score of 2 | Sp. with cover score of 3 | Sp. with cover score of 4 | Indicator score* |
|---|---|---|---|---|---|---|
| *Bossiaea buxifolia* | + | | | | | 2 |
| *Bothriochloa macra* | 2 | | 1 | | | |
| *Chrysocephalum apiculatum* | 2 | | 1 | | | 1 |
| *Convolvulus erubescens* | r | | | | | |
| *Cymbonotus lawsonianus* | + | | | | | |
| *Daucus glochidiatus* | + | | | | | |
| *Desmodium varians* | r | | | | | 2 |
| *Einadia nutans* | + | | | | | |
| *Elymus scaber* | 1 | 1 | | | | |
| *Eryngium ovinum* | + | | | | | 2 |
| *Eucalyptus bridgesiana* | 3 | | | | | |
| *Geranium solanderi* | + | | | | | |
| *Glycine clandestine* | r | | | | | 2 |
| *Gonocarpus tetragynus* | 1 | 1 | | | | 1 |
| *Hydrocotyle laxiflora* | 1 | 1 | | | | 2 |
| *Isoetopsis graminifolia* | + | | | | | 2 |
| *Lomandra filliformis* | + | | | | | 1 |
| *Microlaena stipoides* | r | | | | | |
| *Oreomyrrhis eriopoda* | + | | | | | 2 |
| *Oxalis perennans* | + | | | | | |
| *Panicum effusum* | 1 | 1 | | | | |
| *Plantago varia* | 1 | 1 | | | | 2 |
| *Poa meionectes* | + | | | | | |
| *Poa sieberiana* | 1 | 1 | | | | |
| *Rumex brownii* | + | | | | | |
| *Schoenus apogon* | + | | | | | |
| *Scleranthus diander* | 1 | 1 | | | | 2 |
| *Solenogyne dominii* | + | | | | | |

| Species | Sp. cover score | Sp. with cover score of 1 | Sp. with cover score of 2 | Sp. with cover score of 3 | Sp. with cover score of 4 | Indicator score* |
|---|---|---|---|---|---|---|
| *Swainsona sericea* | 1 | 1 | | | | 2 |
| *Themeda australis* | 1 | 1 | | | | |
| *Vittadinia mulleri* | + | | | | | |
| *Wahlenbergia sp.* | + | | | | | |
| **Total native species** | **37** | **11** | **2** | **1** | **0** | **14** |
| **Cumulative cover** | **5 (>75%)** | | | | | |
| **CONTROL PLOT 2** | | | | | | |
| **Exotic** | | | | | | |
| *Aria sp.** | 1 | 1 | | | | |
| *Centaurium sp.** | 1 | 1 | | | | |
| *Conyza sp.** | + | | | | | |
| *Gamochaeta purpurea** | 1 | 1 | | | | |
| *Hypericum perforatum** | r | | | | | |
| *Hypochaeris radicata** | 1 | 1 | | | | |
| *Rosa rubiginosa** | r | | | | | |
| *Trifolium sp.** | r | | | | | |
| *Trifolium arvense** | 1 | 1 | | | | |
| *Vulpia sp.** | 1 | 1 | | | | |
| **Total exotic species** | **10** | **6** | | | | |
| **Cumulative cover** | **2- (5-25%-)** | | | | | |
| **Native** | | | | | | |
| *Acaena ovina* | + | | | | | |
| *Arthropodium milleflorum* | 1 | 1 | | | | 2 |
| *Asperula conferta* | + | | | | | 2 |
| *Austrodanthonia sp.* | 1 | 1 | | | | |
| *Austrostipa scabra* | 1 | 1 | | | | |
| *Chelianthes sieberi* | + | | | | | |
| *Chrysocephalum apiculatum* | 2 | | 1 | | | 1 |

| Species | Sp. cover score | Sp. with cover score of 1 | Sp. with cover score of 2 | Sp. with cover score of 3 | Sp. with cover score of 4 | Indicator score* |
|---|---|---|---|---|---|---|
| *Cymbonotus lawsonianus* | + | | | | | |
| *Desmodium varians* | + | | | | | 2 |
| *Eragrostis sp.* | + | | | | | |
| *Eucalyptus melliodora* | 2 | | | | | |
| *Eucalyptus bridgesiana* | r | | | | | |
| *Euchiton sp.* | + | | | | | |
| *Geranium solanderi* | + | | | | | |
| *Gonocarpus tetragynus* | 1 | 1 | | | | 1 |
| *Hydrocotyle laxiflora* | 1 | 1 | | | | 2 |
| *Hypericum gramineum* | 1 | 1 | | | | 2 |
| *Kunzea ericoides* | + | | | | | |
| *Leptorhynchos squamatus* | 1 | 1 | | | | 2 |
| *Lomandra filliformis* | + | | | | | 1 |
| *Luzula densiflora* | r | | | | | 2 |
| *Melichrus urceolatus* | r | | | | | 2 |
| *Panicum effusum* | r | | | | | |
| *Poa ? meionectes* | 1 | 1 | | | | |
| *Stackhousia monogyna* | r | | | | | 2 |
| *Themeda australis* | 4 | | | | 1 | |
| *Tricoryne elatior* | r | | | | | 2 |
| *Vittadinia cuneata* | 1 | 1 | | | | |
| *Wahlenbergia sp.* | 1 | 1 | | | | |
| **Total native species** | **27** | **10** | **1** | | **1** | **13** |
| **Cumulative cover** | **5 (>75%)** | | | | | |

**Note: *Eucalypt* species not included in cover score tally.**

**Table 10: Floristic data – monitoring plots autumn 2015.**

| Species | Plot 1 | Plot 2 | Plot 3 | Plot 4 | Plot 5 | Plot 6 | Plot 7 | Plot 8 | Plot 9 | Plot 10 | Plot 11 | Plot 12 | Plot 13 | Plot 14 | Plot 15 | Plot 16 | Plot 17 | Plot 18 | Plot 19 | Plot 20 | Plot 21 | Plot 22 | Plot 23 | Plot 24 | Plot 25 | No. of plots in which sp. occurs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***NATIVE SPECIES*** | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Acacia dealbata* | | r | | | | | | | | | | | | | | | | | | | | | | | | **1** |
| *Acaena ovina* | | r | | | | | | | r | | | | | | | + | r | + | | + | | | | | r | **7** |
| *Alternanthera sp.* | | | | | + | | | | | | | | | | | | | | | | | | | | | **1** |
| *Aristida ramosa* | | 1 | | | | | | | | | | | | | | | | | | r | | | | | | **2** |
| *Arthropodium mille* | | | | | | | | | | | | | | | | | | | | | | r | | | | **1** |
| *Asperula conferta* | | | | | | | | | | | | | | | | | 1 | | | | | r | | | | **2** |
| *Austrodanthonia sp.* | 1 | 1 | 1 | 1 | 1 | | | | 1 | 1 | | | | | 1 | 2- | 2- | 1 | 2- | 1 | 1 | 1 | 2 | 1 | 2 | **18** |
| *Austrostipa bigeniculata* | + | 1 | 1 | 1 | + | + | | | 1 | + | | + | | | | | 1 | 1 | + | + | | + | + | + | 1 | **17** |
| *Austrostipa scabra* | 1 | 1 | 2- | 1 | 1 | 1 | | | 1 | 1 | | | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | **18** |
| *Bossiaea buxifolia* | | | | | | | | | | | | | | | | r | | | | | | | | | | **1** |
| *Bothriochloa macra* | 1 | 1 | 2- | 2+ | 3- | 2+ | | | 3 | 2- | | + | | | 2 | 2 | 2 | 1 | 1 | 2- | 1 | 2- | 1 | 2- | 1 | **20** |
| *Brachyloma daphnoides* | | | | | | | | | | | | | | | | r | | | | r | | | | | | **2** |
| *Carex appressa* | | | | | | | | | | | | | | | | | | | | | | | | | r | **1** |
| *Carex breviculmis* | | | | | | | | | | | | | | | | | | | | + | | | | | | **1** |
| *Carex inversa* | + | + | + | | | | | | | | | | | | | | | | | | | | | | | **3** |
| *Cassinia sp.* | | | | | | | | | | | | | | | | r | | | | | | | | | | **1** |
| *Chamaesyce drummondii* | | | 1 | 1 | | 1 | | | 1 | | | r | | | r | r | | + | | 1 | | | + | r | | **11** |
| *Cheilanthes sieberi* | | + | r | + | | | | | | | | | | | r | r | | | | 1 | | | | | | **6** |
| *Chloris truncata* | 1 | 1 | 1 | 2+ | 1 | 1 | | | 1 | 1 | | 1 | | | 1 | 1 | 1 | 1 | 2- | 1 | 1 | 1 | 1 | 1 | 1 | **20** |
| *Chrysocephalum apiculatum* | | | | | | | | | | | | | | | | | r | + | | 1 | | + | | | | **4** |
| *Convolvulus erubescens* | | | | | | | | | | | | | | | | r | | r | | | | | | | | **2** |
| *Cullen microphyllum* | | | | | | | | | | | | | | | | | r | | | | | | | | | **1** |
| *Cymbonotus lawsonianus* | + | + | | | | | | | | | | | | | r | 1 | + | + | | 1 | + | 1 | + | | | **10** |
| *Daucus ? glochidiatus* | | | | | | | | | | | | | | | | | | | | | | | r | | | **1** |

| Species | Plot 1 | Plot 2 | Plot 3 | Plot 4 | Plot 5 | Plot 6 | Plot 7 | Plot 8 | Plot 9 | Plot 10 | Plot 11 | Plot 12 | Plot 13 | Plot 14 | Plot 15 | Plot 16 | Plot 17 | Plot 18 | Plot 19 | Plot 20 | Plot 21 | Plot 22 | Plot 23 | Plot 24 | Plot 25 | No. of plots in which sp. occurs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Desmodium varians* | | | | | | | | | r | | | | | | r | r | | | | | | | | | | **3** |
| *Dichelachne sp.* | | | | r | | | | | | | | | | | | | | | | | | r | | | | **2** |
| *Dichondra repens* | | | | | + | | | | | | | | | | | | | | | | | r | | | | **2** |
| *Dillwynia sericea* | | r | | | | | | | | | | | | | | | | | | | | | | | | **1** |
| *Elymus scaber* | 1 | 1 | 1 | 1 | 1 | + | | | 1 | 1 | | | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | **19** |
| *Enneapogon nigricans* | | | | | | | | | | | | | | | | | | | | 1 | | | | | | **1** |
| *Epilobium billardierianum* | | | | | | | | | | | | | | | | | | | | + | | | | | | **1** |
| *Eragrostis brownii* | | | | | | | | | | | | | | | | | | | | | | + | + | + | | **3** |
| *Eragrostis sp.* | | | | | | | | | | | | + | | | | | 1 | | | | | | | | 1 | **3** |
| *Eragrostis trachycarpa* | 1 | 1 | | | 1 | 1 | | | 1 | 1 | | 1 | | | | | 1 | 1 | + | | | r | 1 | | 1 | **13** |
| *Erodium crinitum* | | | | | | r | | | | | | | | | | | | | | | | r | | | | **2** |
| *Eryngium ovinum* | | | | | | | | | | | | | | | | | | | | | | | r | | | **1** |
| *Eucalyptus bridgesiana* | | r | | | | | | | | | | | | | | | | | | | | | | | | **1** |
| *Eucalyptus mannifera* | | r | | | | | | | | | | | | | | | | | | | | | | | | **1** |
| *Eucalyptus melliodora* | | r | + | | + | | | | | r | | | | | | | + | | | | | | | + | r | **7** |
| *Euchiton sp.* | + | + | | | | r | | | | | | r | | | | | r | + | r | + | | | + | | | **9** |
| *Geranium retrosum* | | | | | | | | | | | | | | | | | | | | r | | | | | | **1** |
| *Geranium solanderi* | | r | + | r | + | + | | | | r | | | | | 1 | | 1 | 1 | | + | + | + | + | r | + | **15** |
| *Glycine sp.* | | | | | | | | | | | | | | | | | | r | | | | | | | | **1** |
| *Glycine tabacina* | | | | | | | | | | | | | | | | | | | | r | | | | | | **1** |
| *Gonocarpus tetragynus* | | 1 | | | | | | | | | | | | | r | 1 | | + | | 1 | | + | | | | **6** |
| *Haloragis heterophylla* | | + | | | 1 | | | | 1 | 1 | | | | | r | + | 1 | | | | | | | | | **7** |
| *Hibbertia obtusifolia* | | + | | | | | | | | | | | | | | r | | | | | | | | | | **2** |
| *Hydrocotyle laxiflora* | | + | | | 1 | | | | | | | | | | | | | | | | | | 1 | | | **3** |
| *Hypericum gramineum* | | + | | | 1 | | | | + | | | | | | | + | 1 | | | | | r | | | | **6** |
| *Juncus australis* | | | | | | | | | | r | | | | | | | 1 | | | | | | r | | r | **4** |

| Species | Plot 1 | Plot 2 | Plot 3 | Plot 4 | Plot 5 | Plot 6 | Plot 7 | Plot 8 | Plot 9 | Plot 10 | Plot 11 | Plot 12 | Plot 13 | Plot 14 | Plot 15 | Plot 16 | Plot 17 | Plot 18 | Plot 19 | Plot 20 | Plot 21 | Plot 22 | Plot 23 | Plot 24 | Plot 25 | No. of plots in which sp. occurs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Juncus filicaulis* | + | | | | 1 | | | | | + | | | | | | | 1 | | r | + | | | + | | | **7** |
| *Lachnagrostis filiformis* | | r | | | | | | | | | | | | | | | + | | | | | | | | | **1** |
| *Leptorhynchos squamatus* | | | | | | | | | | | | | | | | | | | | 1 | | | | | | **1** |
| *Lomandra filiformis* | | | | | | | | | + | | | | | | | | | | | + | | + | + | + | | **5** |
| *Microlaena stipoides* | 1 | 2- | 2- | 1 | 1 | 2 | | | 1 | 1 | | | | | 1 | 2 | 1 | 1 | 1 | + | 1 | 1 | 1 | 1 | | **18** |
| *Ophioglossum lusitanicum* | | | | | | | | | r | | | | | | | | | | | | | | | | | **1** |
| *Oxalis perennans* | + | r | 1 | + | 1 | 1 | | | 1 | 1 | | | | | 1 | 1 | 1 | + | + | 1 | | r | + | + | r | **18** |
| *Panicum effusum* | 2- | 1 | 1 | 2- | 1 | 1 | | | 1 | 1 | | 1 | | | 1 | 1 | 1 | 3 | 2- | 3 | 1 | 2- | 1 | 1 | 1 | **20** |
| *Persicaria prostrata* | | | | | | | | | | | | | | | 1 | | r | | | | | | | | + | **3** |
| *Plantago varia* | | | | | | | | | | | | | | | | | | 1 | | | | 1 | | | | **2** |
| *Poa labillardierei* | | | | | | | | | | | | | | | | | 1 | | | r | | | | | | **2** |
| *Poa sieberiana* | + | | | + | + | + | | | | r | | r | | | | | | | | | | | | | | **6** |
| *Pseudognaphalium luteoalbum* | | | | r | | | | | + | | | r | | | | | r | | | | | | | | | **4** |
| *Rumex brownii* | | | | r | 1 | 1 | | | r | + | | | | | + | r | + | + | | + | r | | | | | **11** |
| *Schoenus apogon* | | | | | | | | | | | | | | | | | r | | | | | | | | r | **2** |
| *Senecio quadridentatus* | | r | | | | | | | | + | | | | | + | | + | | | | | | | | | **4** |
| *Solenogyne dominii* | | | | | | | | | r | | | | | | | | | | | | | r | r | | | **3** |
| *Stackhousia monogyna* | | | | | | | | | | | | | | | | r | | | | | | r | | | | **2** |
| *Stellaria pungens ?* | | | | | | | | | | | | | | | | | r | | | | | | | | | **1** |
| *Swainsona sericea* | | | | | | | | | | | | | | | | + | | | | | | | | | | **1** |
| *Themeda australis* | 1 | 2- | 1 | 2- | 2- | 1 | | | 2 | 2- | | | | | 1 | 1 | 2 | 1 | 1 | 2- | 1 | 1 | + | + | 1 | **19** |
| *Veronica gracilis* | | | | | | | | | | | | | | | | | + | | | | | | | | | **1** |
| *Vittadinia muelleri* | | | | | | | | | | | | | | | | | 1 | | | r | r | | | | | **3** |
| *Wahlenbergia sp.* | r | r | 1 | 1 | 1 | | | | 1 | 1 | | | | | + | + | 1 | + | | 1 | | 1 | 1 | | + | 15 |
| ***Sp. with score of 1*** | **8** | **10** | **9** | **7** | **14** | **8** | - | - | **12** | **10** | - | **3** | - | - | **10** | **8** | **18** | **11** | **5** | **13** | **8** | **9** | **10** | **6** | **8** | |

| Species | Plot 1 | Plot 2 | Plot 3 | Plot 4 | Plot 5 | Plot 6 | Plot 7 | Plot 8 | Plot 9 | Plot 10 | Plot 11 | Plot 12 | Plot 13 | Plot 14 | Plot 15 | Plot 16 | Plot 17 | Plot 18 | Plot 19 | Plot 20 | Plot 21 | Plot 22 | Plot 23 | Plot 24 | Plot 25 | No. of plots in which sp. occurs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sp. with score of 2** | 1 | 2 | 3 | 4 | 1 | 2 | - | - | 1 | 2 | - | - | - | - | 1 | 3 | 3 | - | 3 | 2 | - | 2 | 1 | 1 | 1 | |
| **Sp. with score of 3** | - | - | - | - | 1 | - | - | - | 1 | - | - | - | - | - | - | - | - | 1 | - | 1 | - | - | - | - | - | |
| **Sp. with score of 4** | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | |
| **Sp. with score of 5** | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | |
| ***TOTAL NATIVE*** | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Total cover autumn 2015** | 2+ | 3- | 3 | 3+ | 3+ | 3- | - | - | 3+ | 3- | - | 1 | - | - | 2+ | 3- | 4 | 3+ | 3- | 3+ | 2 | 3- | 3- | 2+ | 2+ | |
| Total cover spring 2014 | 2 | 2+ | 2+ | 3 | 3- | 2+ | 2 | - | 3 | 3- | 2- | 1 | - | - | 2 | 3- | 4- | 3- | 2+ | 3- | 2+ | 2+ | 2+ | 2 | 2+ | |
| Total cover autumn 2014 | 2+ | 2+ | 2+ | 2* | 3+^ | 3 | 2 | - | 3* | 3 | 2 | 2 | - | - | 2 | 2+ | 4- | 3- | 2 | 3+ | 2 | 2 | 3- | 2 | 2 | |

***EXOTIC SPECIES***

| Species | Plot 1 | Plot 2 | Plot 3 | Plot 4 | Plot 5 | Plot 6 | Plot 7 | Plot 8 | Plot 9 | Plot 10 | Plot 11 | Plot 12 | Plot 13 | Plot 14 | Plot 15 | Plot 16 | Plot 17 | Plot 18 | Plot 19 | Plot 20 | Plot 21 | Plot 22 | Plot 23 | Plot 24 | Plot 25 | No. of plots in which sp. occurs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Acetosella vulgaris** | + | 1 | 2+ | 1 | 1 | + | | | | + | | + | | | + | + | | 1 | + | 1 | + | | + | | | **15** |
| *Anagallis arvensis** | + | + | r | | + | + | | | + | r | | r | | | + | + | r | | | | | | | | | **11** |
| *Avena sp.** | | | | | | 1 | | | | + | | | | | r | | | | | | | | | | | **3** |
| *Briza sp.** | | | | | | | | | | | | | | | | | r | | | | | | | | | **1** |
| *Bromus sp.** | 1 | | 1 | 1 | 1 | 1 | | | 1 | 1 | | 1 | | | | | | 2 | 1 | 1 | + | 1 | 2 | 1 | 1 | **16** |
| *Carthamus lanatus** | | | | | | 1 | | | | | | | | | | | | | | + | | | | | | **2** |
| *Centaurium sp.** | r | 1 | + | 1 | + | + | | | 1 | + | | + | | | 1 | 1 | 1 | | | | + | 1 | 1 | | 1 | **16** |
| *Chenopodium ? album** | | | r | | | | | | | | | | | | | | | | | | | | | | | **1** |
| *Chondrilla juncea** | | | | | | | | | | | | r | | | | | | | | | | r | | | | **2** |
| *Cirsium vulgare** | | r | 1 | + | 1 | + | | | + | r | | | | | + | + | r | + | + | | | + | + | r | | **15** |
| *Conyza sp.** | + | r | r | | + | 1 | | | + | | | + | | | 1 | 1 | | 1 | 1 | r | | 1 | 1 | 1 | + | **16** |
| *Cynodon dactylon** | | | 2+ | | | | | | r | | | r | | | | | | | + | | | | | + | | **5** |
| *Cyperus eragrostis** | | | | | | | | | | | | | | | | | | | r | | | | | | | **1** |
| *Dactylis glomerata** | | | | | | + | | | | | | 4– | | | + | | + | | | | | | | | | **4** |
| *Echinochloa esculenta** | | | | | | | | | | | | r | | | | | | | | | | | | | | **1** |
| *Echium plantagineum** | | | | | | | | | | | | + | | | | | | | | | | | | | | **1** |
| *Echium vulgare** | | | | | | | | | | | | | | | 1 | 1 | | | | | + | | | | r | **4** |
| *Eleusine tristachya** | | | | | 1 | + | | | | | | | | | | | | 1 | 1 | | | | + | 1 | 1 | **7** |
| *Eragrostis cillianensis** | | | | | | | | | | | | r | | | | | | | | | | | | | | **1** |
| *Eragrostis curvula** | r | r | | | | | | | | | | 1 | | | | | | | | | | | | + | 1 | **5** |
| *Eragrostis sp.** | | | | | | | | | | | | | | | | | | | | r | | | | | | **1** |
| *Erodium botrys** | | | | | | | | | | | | | | | | + | | | | | | | | | | **1** |
| *Erodium cicutarium** | | | | | | r | | | r | | | | | | r | + | | 1 | | 1 | | | + | | | **7** |
| *Festuca elatior** | | | | | + | | | | | | | 1 | | | | | | | | | | | | | | **1** |
| *Gamochaeta ? calviceps** | + | | | | | | | | | | | | | | | | | | | | | | | | | **1** |

***EXOTIC SPECIES***

| Species | Plot 1 | Plot 2 | Plot 3 | Plot 4 | Plot 5 | Plot 6 | Plot 7 | Plot 8 | Plot 9 | Plot 10 | Plot 11 | Plot 12 | Plot 13 | Plot 14 | Plot 15 | Plot 16 | Plot 17 | Plot 18 | Plot 19 | Plot 20 | Plot 21 | Plot 22 | Plot 23 | Plot 24 | Plot 25 | No. of plots in which sp. occurs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Gamochaeta purpurea** | | | | | | | | | | | | | | | | + | | | | | | | + | | | **2** |
| *Gamochaeta sp.** | | + | | + | | | | | + | | | | | | | | 1 | | | | | + | | | | **5** |
| *Hirschfeldia incana** | | | | | | | | | | | | | | | | + | | | + | | + | | | | | **3** |
| *Holcus lanatus** | | | | | + | | | | | | | | | | | | | | | | | | | | | **1** |
| *Hordeum sp.** | | | | | | | | | | | | | | | | | | + | | | | | | | | **1** |
| *Hypericum perforatum** | + | + | | | | | | | | | | | | | 1 | 1 | | + | + | | 1 | r | r | + | 1 | **11** |
| *Hypochaeris radicata** | 2 | 2- | 3 | 1 | 2 | 2 | | | 1 | 2- | | 1 | | | + | | | 1 | | 1 | r | + | + | | + | **16** |
| *Lolium perenne** | | | | 1 | 1 | | | | | 1 | | + | | | | | | + | | | | 1 | 1 | | 1 | **8** |
| *Marrubium vulgare** | | | | | | | | | | | | | | | | r | | | | | | | | | | **1** |
| *Modiola caroliniana** | | | | | | | | | | | | 1 | | | 1 | | | r | | | | | | | r | **4** |
| *Nassella trichotoma** | | | | + | | | | | | | | | | | | | | | | | | | | r | r | **3** |
| *Oenothera sp.** | | | | | | | | | | | | | | | + | r | | | | | | | | | | **2** |
| *Panicum capillare** | | | | | + | 1 | | | | | | | | | | | | | | | | | | + | | **3** |
| *Paronychia brasiliana** | | | r | | + | | | | | | | | | | | + | | | | | | + | | | | **4** |
| *Paspalum dilatatum** | + | | + | | + | 1 | | | | + | | + | | | | | 1 | | r | | | | | 1 | 2- | **10** |
| *Phalaris aquatica** | | | + | | | 1 | | | | 1 | | 1 | | | | | 1 | | | | | | | | 1 | **6** |
| *Plantago lanceolata** | 1 | r | | | r | 1 | | | + | 3- | | 1 | | | + | | 1 | 1 | + | 2 | + | + | r | 1 | 1 | **17** |
| *Rosa rubiginosa** | r | r | | | | | | | | | | | | | | | | | | | | | | | | **2** |
| *Salvia verbenacea** | | | | | | | | | | | | | | | | | | r | | | | | | | | **1** |
| *Sanguisorba minor** | | | | | | | | | | | | | | | r | | | | | | | | | | | **1** |
| *Setaria sp.** | | | | r | | | | | | + | | | | | | | + | | | | | | | + | | **4** |
| *Silybum marianum** | | | + | | | | | | | | | | | | | | | | | | | | | | | **1** |
| *Solanum nigrum** | | | | | | r | | | | | | | | | r | + | | | | | | | r | | | **4** |
| *Sonchus sp.** | + | + | + | + | + | 1 | | | | | | | | | + | r | | + | r | | | + | 1 | | r | **13** |
| *Taraxacum officinale** | | | + | | + | + | | | + | | | r | | | + | + | r | + | r | + | r | + | r | | | **14** |

***EXOTIC SPECIES***

| Species | Plot 1 | Plot 2 | Plot 3 | Plot 4 | Plot 5 | Plot 6 | Plot 7 | Plot 8 | Plot 9 | Plot 10 | Plot 11 | Plot 12 | Plot 13 | Plot 14 | Plot 15 | Plot 16 | Plot 17 | Plot 18 | Plot 19 | Plot 20 | Plot 21 | Plot 22 | Plot 23 | Plot 24 | Plot 25 | No. of plots in which sp. occurs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Tolpis umbellata** | r | | | | | | | | | | | | | | | | | + | | + | | r | r | | | **5** |
| *Trifolium arvense** | | | | | 1 | | | | | | | + | | | + | + | | 1 | | + | | | | | + | **7** |
| *Trifolium sp.** | | | 1 | + | 1 | r | | | 1 | | | + | | | | + | 1 | 1 | | 1 | r | | 1 | | | **12** |
| *Trifolium subterraneum** | | | | | 1 | | | | | | | + | | | | | 1 | 1 | | | | | 1 | | | **4** |
| *Verbascum thapsus** | | | r | | | | | | | | | r | | | 1 | + | | r | | r | + | | | | | **7** |
| *Verbascum virgatum** | | | | | | | | | | | | | | | | r | | | | | | | | | | **1** |
| *Verbena bonariensis** | | | | | | | | | | | | | | | 3 | + | | | + | | r | | | | | **5** |
| *Vulpia sp** | 1 | 1 | 1 | 1 | 1 | 1 | | | 1 | 1 | | 1 | | | 1 | | 1 | | 1 | 1 | + | 1 | 1 | 1 | | **17** |
| **Sp. with score of 1** | **3** | **3** | **4** | **6** | **9** | **10** | - | - | **5** | **4** | - | **8** | - | - | **7** | **4** | **8** | **9** | **4** | **6** | **1** | **5** | **7** | **6** | **8** | |
| **Sp. with score of 2** | **1** | **1** | **2** | - | **1** | **1** | - | - | - | **1** | - | - | - | - | - | - | - | **1** | - | **1** | - | - | **1** | - | **1** | |
| **Sp. with score of 3** | - | - | **1** | - | - | - | - | - | - | **1** | - | - | - | - | **1** | - | - | - | - | - | - | - | - | - | - | |
| **Sp. with score of 4** | - | - | - | - | - | - | - | - | - | - | - | **1** | - | - | - | - | - | - | - | - | - | - | - | - | - | |
| **Sp. with score of 5** | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | |
| ***TOTAL EXOTIC*** | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Total cover Autumn 2015** | **2** | **2** | **3+** | **2** | **3-** | **2+** | - | - | **2-** | **3+** | - | **4** | - | - | **3** | **1** | **2-** | **2+** | **1** | **2+** | **1** | **1** | **2+** | **2-** | **2** | |
| **Total cover Spring 2014** | 2+ | 2 | 3+ | 3 | 4 | 3+ | 4+ | - | 4- | 3 | 4+ | 4 | - | - | 3 | 2 | 2 | 4 | 2 | 4 | 3 | 3 | 3 | 2 | 3 | |
| **Total cover Autumn 2014** | 1 | 2 | 3 | 2* | 3 | 3 | 4- | - | 2 | 2 | 4- | 4+ | - | - | 3+ | 2- | 2- | 3+ | 2 | 4- | 4- | 2- | 2 | 2- | 3- | |

* = heavily (pulse) grazed in late March early April 2014

^ = lightly grazed in March 2014.

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