



2017 Grassland Quality and Extent Mapping

April 2018

Prepared for Environmental Offsets, ACT Parks and Conservation Service

Document Information

Report for: ACT Parks and Conservation Service

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Capital Ecology project no.: 2759

Citation: Capital Ecology (2018). *2017 Grassland Quality and Extent Mapping*. April 2018. Prepared for Environmental Offsets, ACT Parks and Conservation Service. Authors: S. Reid and R. Speirs. Project no. 2759.

Version Control

| Version | Internal reviewer | External reviewer | Date of issue |
|------------------|-------------------|-------------------|---------------|
| Draft version 01 | Robert Speirs | Melita Milner | 26-03-2018 |
| Final version 01 | Robert Speirs | | 17-04-2018 |

Acknowledgements

Capital Ecology gratefully acknowledges the contributions and/or assistance of the following people and organisations in undertaking this study.

- PCS Environmental Offsets – Melita Milner, Clare McInnes, Sophia Callander and Nic Mikhailovich.
- Lessees of privately leased properties.

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Introduction

Capital Ecology Pty Ltd (Capital Ecology) has been commissioned by the ACT Government Parks and Conservation Service (PCS) to assess and map the quality and extent of the grassland within the following ACT offset reserves and other locations ('sites') (refer Figure 2.1-a):

- Bonshaw (211.83 ha) located in the Jerrabomberra Valley, east of the Monaro Highway;
- Jarramlee (111.51 ha) located in West Belconnen, between the suburb of Macgregor and the ACT border;
- Kenny Grassland (57.25 ha) located in the Gungahlin Valley. Kenny Grassland is the natural grassland component of the offset reserve located north of Morisset Drive, Mitchell;
- Majura West Grassland (95.45 ha) located in the Majura Valley. Majura West Grassland is the natural grassland component of the offset reserve between the Majura Parkway and the Mt Ainslie / Mt Majura woodland nature reserves;
- West Macgregor (36.60 ha) located in West Belconnen, between the suburb of Macgregor and the Jarramlee;
- Woolshed Creek (60.30 ha) located in the Majura Valley, between the Majura Parkway and Old Majura Road, north and south of IKEA Canberra; and
- Yass Valley Lot 2 (86.69 ha) located on the NSW side of the border and formally known as Lot 2 DP1144979.

The sites are managed by PCS for their biodiversity conservation values. Each site is known to support grassland which meets the definition for the 'Natural Temperate Grassland of the South Eastern Highlands' (NTG-SEH) threatened ecological community (TEC) listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the ACT *Nature Conservation Act 2014* (NC Act), and/or habitat for threatened grassland fauna species (e.g. Golden Sun Moth *Synemon plana*, Striped Legless Lizard *Delma impar*). NTG-SEH is listed as critically endangered pursuant to the EPBC Act and endangered pursuant to the NC Act.

The quality and extent of grassland in each of the sites has been mapped previously, however the mapping has been undertaken across several seasons, by numerous practitioners, and using various methods and scales. The objective of this study was to develop a logical and repeatable Geographic Information System (GIS) supported assessment methodology and apply this to produce fine-scale baseline mapping of the current on-ground quality and extent of the grassland within each site. The mapping presented herein is consistent across the seven sites and provides an accurate and reliable foundation for PCS's ongoing management and future monitoring of the significant biodiversity values within.

Note: The previous mapping was provided to Capital Ecology by PCS, however to avoid influencing the mapping results, it was deliberately not reviewed until the report preparation stage of the study.

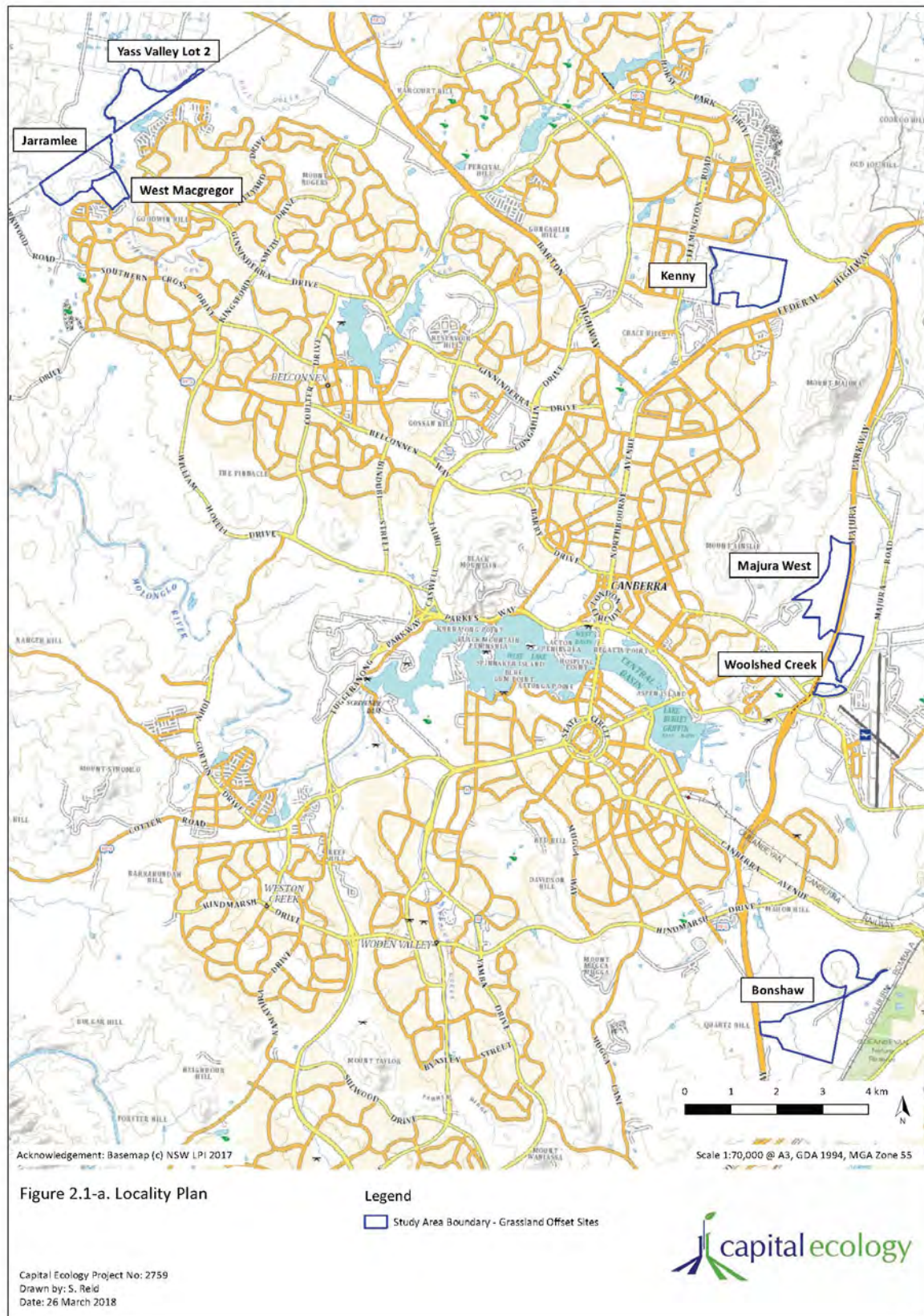
This report is structured in the following manner.

- Section 2 – Methods. Section 2 provides a detailed description of the mapping methodology.
- Section 3 – Results. Section 3 provides the results of the mapping study, presented as text, tables and GIS-prepared figures. The results are presented as a sub-section for each site such

that each may be considered in a standalone manner. Notwithstanding this, the results are presented in a consistent manner across sites to facilitate comparison between sites. A brief discussion is provided for each site describing any interesting observations from the data, or otherwise observed, together with notes comparing the current mapping to previous mapping.

- Section 4 – Summary and Conclusion. Section 4 provides an overview of the study and outline of the key 'project-scale' conclusions and recommendations.
- References – A list of the studies, guidelines, and other documents reviewed and considered during development of the mapping methodology and its on-ground application.
- Appendices – Appendix 1 and Appendix 2 provide the study data presented as summary tables. Appendix 3 provides the PCS Excel Spreadsheets (excel files in separate .zip folder) and Appendix 4 provides the GIS Data (shapefiles in separate .zip folder).

Figure 2.1-a. Locality Plan



Methods

2.1 Four-step temperate vegetation mapping method

The four-step method employed for this study was developed by Capital Ecology in 2015 and has been trialed and improved during its subsequent application at numerous sites across the Southern Tablelands of NSW and the ACT. The method was employed to map the natural grassland at East Jerrabomberra and AMTECH in spring 2016, together with the woodland and derived grassland at Mulangarri and Gungaharra offset reserves (Capital Ecology 2017¹). The four-step method can be used to assess and map each of the Plant Community Types (PCTs) occurring in the lowland areas of the Southern Tablelands of NSW and the ACT. As detailed below, the four-step method draws upon elements of the relevant contemporary Commonwealth Government (Commonwealth of Australia 2016²), ACT Government (ACT Government 2015a³), and NSW Government (NSW Government 2014⁴ 2017⁵) vegetation mapping guidelines, together with other technical guidelines, notably Rehwinkel (2015⁶). Each step of the four-step method has a specific purpose and must achieve a specific outcome which generally becomes the foundation for the subsequent step.

Repeatability is a key element of vegetation mapping methodologies when applied to offset sites which are to be periodically monitored. Accordingly, the four-step method is described in full below.

2.1.2 Step 1. Plant Community Type (PCT) mapping

Purpose = to identify and delineate the boundaries of each PCT within the site.

Outcome = GIS mapping of PCT boundaries.

The on-ground boundaries of each of the PCTs (as defined in ACT Government 2015b⁷) present within the site were accurately mapped using either hand-held GPS or by marking boundaries directly onto high resolution orthorectified aerial photograph field maps (displaying the ACT Government's May 2017 aerial imagery available under CC.4.0) with one metre contours. PCT boundary delineation was undertaken by walking or driving (as deemed most suitable), carefully determining and recording the boundary alignment.

The vegetation within each of the sites has undergone various types and degrees of modification over the last 150 years. This modification often removes or disguises the elements which would have once clearly defined the PCT boundaries (noting that ecotones are usually gradual transitions between vegetation communities, often in excess of 50 m in width). As such, the PCT boundary

¹ Capital Ecology (2017). *ACT Environmental Offsets – 2016 Grassland Mapping Report*. Prepared for ACT Government Parks and Conservation Service.

² Commonwealth of Australia (2016). *Approved conservation advice for the Natural Temperate Grassland of the South Eastern Highlands (NTG–SEH) ecological community*.

³ ACT Government (2015a). *Monitoring Guidelines for Natural Temperate Grasslands*. Conservation Research, October 2015.

⁴ NSW Government (2014). *BioBanking Assessment Methodology 2014*. NSW Government Office of Environment and Heritage.

⁵ NSW Government (2017). *Biodiversity Assessment Method*. Office of Environment and Heritage.

⁶ Rehwinkel (2015). *A Revised Floristic Value Scoring Method to assess grassland condition, an addendum to Friends of Grasslands Forum Proceedings* (30 October – 1 November 2014).

⁷ ACT Government (2015b). *ACT Vegetation Types Database – Attachment to the ACT Environmental Offsets Calculator Assessment Methodology*. 18 May 2015.

delineation involved carefully reading the landscape, considering numerous less conspicuous landscape elements, such as the:

- presence, species, growth form and density of remnant canopy trees and/or stags or stumps of these;
- presence and species of midstorey shrubs and trees;
- floristic composition of the groundstorey; and
- the landscape position and other geographical features (elevation, aspect, soils, apparent hydrology etc.).

Whilst the land within the seven sites would have been vegetated by NTG-SEH pre-1750, the particular grassland association/PCT varies within the sites depending upon the landscape position and other geographical features. However, as is the case across the distribution of NTG-SEH in the broader southeast NSW bioregion, the tendency of exotic pasture species and noxious weeds to proliferate in the poorly drained low-lying areas of the landscape means that most of the NTG-SEH persisting in moderate or better quality is 'PCT-ACT01 – Tablelands Dry Tussock Grassland'. As such, for this study the primary purpose of Step 1 was to identify and delineate the boundary between PCT-ACT01 and the adjoining PCTs (generally 'PCT16 – Tableland Box-Gum Grassy Woodland' upslope of PCT-ACT01).

Step 1 is critical to the accurate mapping of temperate vegetation communities and was completed and mapped in GIS prior to moving on to Step 2.

Note: The portions of the Kenny and West Majura sites identified as supporting a woodland or dry sclerophyll forest PCTs (primarily PCT-ACT16) have been mapped applying this method and are presented in the concurrently prepared report (Capital Ecology 2018⁸).

2.1.3 Step 2. Vegetation zone definition and mapping

Purpose = to identify and delineate the boundaries of each vegetation zone within the site.

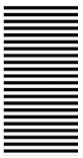
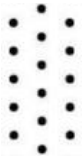

Outcome = GIS mapping of vegetation zone boundaries.

The mapped PCTs were further divided into vegetation zones based on the structure, floristic composition and overall quality ('intactness') of the vegetation. As described above for Step 1, each patch of each discernible (generally homogenous) vegetation zone was accurately mapped using either hand-held GPS or by marking boundaries directly onto recent high resolution orthorectified aerial photograph field maps with one metre contours. There was no minimum patch size, unless the total area for a zone within a site was < 0.1 ha. Vegetation zone boundary delineation was undertaken by walking or driving (as deemed most suitable), carefully determining and recording the boundary alignment.

Table 2.1-a outlines the vegetation zones which were defined for 'PCT-ACT01 Tablelands Dry Tussock Grassland'.

⁸ Capital Ecology (2018). *2017 Woodland Quality and Extent Mapping – ACT Government Environmental Offsets*. Prepared for the ACT Government Parks and Conservation Service.

Table 2.1-a. Vegetation zones for PCT-ACT01 Tablelands Dry Tussock Grassland

| PCT | Groundstorey Dominance Native or Exotic | Native Forb Diversity (Floristic Value Score) Low = FVS of < 5 Mod = FVS of ≥ 5 but < 6.5 High = FVS of ≥ 6.5 | Vegetation Zone ID Colour as per mapping | Reason for Exotic Dominance | |
|--|--|--|---|---|--|
| PCT-ACT01 Tableland Dry Tussock Grasslands | Native | High | 01.1 (NTG-SEH) | N/A | |
| PCT-ACT01 Tablelands Dry Tussock Grassland | Native | Mod and/or >50% cover foliage cover of <i>Carex bichenoviana</i> , <i>Themeda triandra</i> or <i>Poa labillardieri</i> | 01.2 (NTG-SEH) | N/A | |
| PCT-ACT01 Tablelands Dry Tussock Grassland | Native | Low | 01.3 | N/A | |
| PCT-ACT01 Tablelands Dry Tussock Grassland | Exotic | N/A | 01.4 |  | Pasture and Agricultural Weed Species (cultivation or pasture improvement, such as Phalaris pasture) |
| PCT-ACT01 Tablelands Dry Tussock Grassland | Exotic | N/A | 01.4 |  | Stock camp (soil nutrification, annual weed dominance) |
| PCT-ACT01 Tablelands Dry Tussock Grassland | Exotic | N/A | 01.4 |  | Noxious weed Species (e.g. dense Serrated Tussock or Chilean Needle Grass) |

As detailed in Table 2.1-a, an additional mapping layer was developed for Zone 4 (exotic groundstorey dominance) to differentiate areas by the key reason for the exotic dominance (i.e. Stock Camp, Noxious Weed Species, Pasture and Agricultural Weed Species). This additional mapping layer was developed to assist PCS in managing the sites given that the required management measures differ depending upon the reason for the exotic dominance. For example, the dense Chilean Needle Grass *Nassella neesiana* along the Ginninderra Creek flats (refer Section 3.2) may require intensive herbicide application to prevent its spread, however time since stocking is required to rehabilitate the nutrient rich stock camps at Bonshaw (refer Section 3.1).

With regard to the above, it is important to note that the exotic dominance category mapping does not reflect the extent to which any exotic species (or group of exotic species) occurs within a site. Many of the exotic species occur more broadly within the sites, including within native dominated vegetation zones.

The vegetation zones defined are consistent across all sites. This permits direct comparison between offset sites and the values within and assists in determining the type and prioritisation of management activities.

With the exception of stock camps and areas subject to other forms of groundstorey modification, the presence of planted trees in grassland PCTs does not usually prevent recognition of the groundcover vegetation characteristics. Patches can retain the floristic composition and structure of NTG-SEH despite shading and other impacts of planted trees, and in many cases would be characteristically similar to the surrounding areas if the trees were removed. Accordingly, the definition of vegetation zones for this study was undertaken ignoring the presence of planted trees or other woody vegetation.

Step 2 was completed and mapped in draft form in GIS prior to moving on to Step 3. GIS mapping of vegetation zones allows for accurate calculations of the total area of each vegetation zone within the site.

2.1.4 Step 3. Data collection (survey quadrats and transects) – Grassland PCTs

Purpose = to record the floristic composition and structure of each vegetation zone.

Outcome = recorded floristic composition and structure data.

Step 3 for natural grassland PCTs was based on ACT Government (2015) and Rehwinkle (2015). Specifically, the following was completed for each site.

1. 20 m x 20 m (400 m²) quadrats (i.e. plots) were completed in locations deemed via observation during Steps 1 and 2 to support the highest floristic diversity within the vegetation zone.

The number of plots completed within each vegetation zone at each site was determined by the area of the vegetation zone defined (using GIS) during Step 2 and the below.

- 1 plot per homogenous vegetation zone of 2 ha or less;
- 3 to 4 plots per homogenous vegetation zone between 2 and 50 ha; or
- 4 to 10 plots per homogenous vegetation zone between 51 and 250 ha.

The north-west corner point of the plot was recorded with a handheld GPS unit and marked with an orange plastic marker stake or orange cattle tag. The plot was then established using a compass, with the x axis running 90 degrees (due east), and the y axis running 180 degrees (due south). The plot was then marked using three measuring tapes (two tapes for side boundaries and one to define the diagonal). Note: plots were established as described as it is critical for future monitoring that plots can be replicated in a precise manner.

Modified Braun-Blanquet cover/abundance scores (Table 2.1-b) were assigned for each species recorded within the plot.

Table 2.1-b. Modified Braun-Blanquet cover/abundance scores

| Cover/Abundance | Explanation |
|-----------------|---|
| 1 | < 5% cover and solitary (<4 individuals) |
| 2 | < 5% cover and few (4-15 individuals) |
| 3 | < 5% cover and numerous/scattered (>15 individuals) |
| 4 | 5% to < 25% cover |
| 5 | 25% to < 50% cover |
| 6 | 50% to < 75% cover |
| 7 | 75% cover and greater |

2. One 50 m step-point transect was completed to accompany each plot. The transects were placed in locations deemed via observation to support structural characteristics representative of the vegetation zone. At each 1 m point along the step-point transect the ground layer was allocated to one of the following options:
 - Cryptogams (Moss/Lichen)
 - Bare Earth
 - Rocks
 - Litter/Dead Vegetation
 - Annual Exotic Grass
 - Perennial Exotic Grass
 - Exotic Broadleaf
 - Perennial Native Grass
 - Other native
3. Data was entered in the provided spreadsheets to calculate the floristic value scores (FVS), species richness, and other characterising features of the vegetation zones. Several minor edits were made to the excel spreadsheets, notably to add species recorded in the plots but not provided in the spreadsheets.

Each plot and step-point transect was allocated a four-part identification code as per the below example. Note: only the plot identification code is displayed on vegetation zone mapping for each site, the identification code for the accompanying step-point transect is not displayed to avoid congestion.

- i. Site = Jarramlee → Code Part 1 = **Ja**
- ii. PCT = ACT01 → Code Part 2 = **01**
- iii. Vegetation zone = 3 → Code Part 3 = **3**
- iv. Plot/transect number = 2 → Code Part 4 = **2**



- Plot identification code = **Ja_01.3.2.P**
- Transect identification code = **Ja_01.3.2.T**

The north-west corner point of each plot and the start and end points of each step-point transect are provided in the tables for each site in the relevant sections. As detailed above, the north-west corner point is required to navigate to the installed orange marker, and once located the marker can be used to accurately replicate the plot.

Table 2.1-c provides the survey dates and number of plots per vegetation zone at each site (total for study = 88 plots). The timing of the 2017 surveys was determined in order to ensure that all plots

and transects were completed during optimal seasonal conditions. Accordingly, these dates should be replicated as closely as possible for future monitoring purposes.

Table 2.1-c. Survey dates and plot numbers per vegetation zone

| Site | Survey Dates | Number of Plots/ Transects Zone 1 | Number of Plots/ Transects Zone 2 | Number of Plots/ Transects Zone 3 | Number of Plots/ Transects Zone 4 | Total |
|-----------------------|--------------|---|---|---|---|-------|
| Bonshaw | 7/12/2017 | 3 | 2 | 10 | 4 | 19 |
| Jarramlee | 12/12/2017 | 4 | 5 | 5 | 5 | 19 |
| Kenny Grassland | 18/12/2017 | - | - | 4 | 4 | 8 |
| Majura West Grassland | 8/12/2017 | 4 | 2 | 4 | 4 | 14 |
| West Macgregor | 13/12/2017 | - | - | 4 | 4 | 8 |
| Woolshed Creek | 5/12/2017 | - | - | 4 | 4 | 8 |
| Yass Valley Lot 2 | 21/12/2017 | 4 | - | 4 | 4 | 12 |

All threatened/rare flora and fauna species observed during Steps 1 to 3 were recorded with a GPS waypoint, these records are detailed under the relevant site subsection. A photograph of was also taken of each threatened/rare flora species and the record has been lodged with Canberra Nature Map.

2.1.5 Step 4. Threatened Ecological Community (TEC) determination

Purpose = to determine the areas of the site which support EPBC Act NTG.

Outcome = data supported GIS mapping of the EPBC Act NTG-SEH within each site.

The data recorded during Step 3 for each of the native vegetation zones was analysed to determine whether the vegetation zone meets the listing criteria for the EPBC Act critically endangered ecological community 'Natural Temperate Grassland of the South Eastern Highlands' (NTG-SEH), either as the 'high to very high' or 'moderate to high' condition threshold category. Table 2.1-d presents a flowchart of the key elements of the EPBC Act listing criteria for NTG-SEH, drawn from the text and tables in Section 1.5.2 of Commonwealth of Australia (2016).

Table 2.1-d. Summary of condition thresholds for EPBC Act Natural Temperate Grassland of the South Eastern Highlands (NTG–SEH)

| Condition Threshold Category | Scenarios | Vegetation Zone Red Colour as per mapping |
|------------------------------|--|--|
| High to Very High | <ol style="list-style-type: none"> The percentage cover of native vascular plants (including annual and perennial species) in the patch is greater than the percentage cover of perennial exotic species AND (in 0.04 ha sampling plots): At any time of the year: <ol style="list-style-type: none"> At least 12 non-grass native species OR At least 3 indicator species OR A floristic value score (FVS) of at least 6.5 | ACT01 – Zone 1 |

| Condition Threshold Category | 'A' scenarios | 'B' scenarios | Vegetation Zone Orange Colour as per mapping |
|------------------------------|---|--|---|
| Moderate to High | <ol style="list-style-type: none"> The patch is characterised by at least 50 % foliage cover of the ground of <i>Themeda triandra</i>. The patch is characterised by at least 50 % foliage cover of the ground of <i>Poa labillardieri</i>. The patch is characterised by at least 50 % foliage cover of the ground of <i>Carex bichenoviana</i>, or at least 50 tussocks for every 100 m². | <ol style="list-style-type: none"> The percentage cover of native vascular plants (including annual and perennial species) in the patch is greater than the percentage cover of perennial exotic species AND (in 0.04 ha sampling plots): During favourable sampling times: <ol style="list-style-type: none"> At least 8 non-grass native species OR At least 2 indicator species OR A floristic value score (FVS) of at least 5 | ACT01 – Zone 2 |

Results

A summary of results for each site is provided in the following Subsections 3.1 to 3.7, together with a table and representative photograph for each vegetation zone ('zone').

A number of weeds, such as St John's Wort *Hypericum perforatum*, are not listed as a category X species (i.e. significant weeds) in the excel spreadsheet provided or in Rehwinkle (2015). However, all weeds that were particularly widespread within each site are highlighted in the following subsections.

3.1 Bonshaw

3.1.1 Grassland mapping results

Figure 3.1-a shows the extent of the grassland PCT and zones for Bonshaw, the location of the floristic quality plots and step-point transects, and the associated Floristic Value Scores ('FVS'). The location of the NW corner of each plot and the start/end location of transects are provided in Appendix A and B, respectively.

Bonshaw was found to support one PCT: 'ACT01 Tablelands Dry Tussock Grassland', with the following zones.

- 1.80 ha of Zone 1: Native dominant – High to very high diversity (meeting the EPBC Act criteria for NTG-SEH in 'high to very high condition').
- 0.66 ha of Zone 2: Native dominant – Moderate to high diversity (meeting the EPBC Act criteria for NTG-SEH in 'moderate to high condition').
- 164.95 ha of Zone 3: Native dominant – Low diversity (not meeting the EPBC Act criteria for NTG-SEH).
- 41.81 ha Zone 4: Exotic dominated – Low diversity.

In total, 2.46 ha of grassland in Bonshaw meets the EPBC Act criteria for NTG-SEH (Figure 3.1-b).

Native species richness ranged from 0 native species (Bo_01.4.2) to 20 native species (Bo_1.1.1). The FVS varied from 0 (Bo_01.4.2) to 21.71 (Bo_01.1.3).

Figure 3.1-c shows the exotic dominance categories for Bonshaw. The majority of the exotic areas were classified as 'Pasture and Agricultural Weed Species', with a few 'Stock Camps' located within the site.

Significant weeds were found throughout the site, including African Lovegrass *Eragrostis curvula* (all zones), Serrated Tussock *Nassella trichotoma* (Zones 1-3), Chilean Needle Grass *Nassella neesiana* (Zone 2), Phalaris *Phalaris aquatica* (Zones 2-4), Paspalum *Paspalum dilatatum* (Zones 3 and 4) and Tall Fescue *Festuca arundinacea*. (Zone 4). Other pest plants that were widespread include St John's Wort and Saffron Thistle *Carthamus lanatus*.

No threatened or rare species were recorded.

Tables 3.1a-3.1d provide summaries of the plot results for each zone. Detailed summaries of the floristics and step-point transects for each plot are provided in Appendix 1 and 2, respectively.

Table 3.1-a. Bonshaw ACT01 Zone 1 results summary

| | ACT01 Zone 1 |
|--------------------------------|---|
| Description | NTG-SEH. Native-dominated (Austrostipa/Rytidosperma/Bothriochloa association), supporting a high to very high diversity of native grass and forb species. |
| Size | 1.80 ha (3 plots and 3 transects). |
| Native Species Richness | 14-20 total native species, 9-14 native non-grass species, 6-7 indicator species. |
| Exotic Species Richness | 8-11 species. |
| Significant Weeds | African Lovegrass and Serrated Tussock, with a low combined cover (less than 5%). Saffron Thistle also present. |
| WVS | Average of 6.36 (range of 4.83 to 9.38). |
| FVS | Average of 20.14 (range of 18.09 to 21.71). |



Table 3.1-b. Bonshaw ACT01 Zone 2 results summary

| | ACT01 Zone 2 |
|-------------------------|--|
| Description | NTG-SEH. Native-dominated (Austrostipa/Rytidosperma association), supporting a moderate to high diversity of native grass and forb species. |
| Size | 0.66 ha (2 plots and 2 transects). |
| Native Species Richness | 9-9 total native species, 6-7 native non-grass species, 2-4 indicator species. |
| Exotic Species Richness | 9-16 species. |
| Significant Weeds | African Lovegrass, Chilean Needle Grass, Serrated Tussock and Phalaris, with a low combined cover (less than 5%). St John's Wort and Saffron Thistle also present. |
| WVS | Average of 9.68 (range of 7.62 to 11.74). |
| FVS | Average of 9.05 (range of 7.58 to 10.52). |



Table 3.1-c. Bonshaw ACT01 Zone 3 results summary

| | ACT01 Zone 3 |
|-------------------------|---|
| Description | Native grassland. Native-dominated (Austrostipa/Rytidosperma association), with some forbs present. This zone has lower diversity than Zone 1 and Zone 2 and does not meet the EPBC Act criteria for NTG-SEH. |
| Size | 164.95 ha (10 plots and 10 transects). |
| Native Species Richness | 4-10 total native species, 1-4 native non-grass species, 0-2 indicator species. |
| Exotic Species Richness | 4-14 species. |
| Significant Weeds | African Lovegrass, Serrated Tussock, Paspalum and Phalaris, with a low to moderate combined cover (less than 5% up to 25%). St John's Wort and Saffron Thistle also present. |
| WVS | Average of 6.57 (range of 2.52 to 13.07). |
| FVS | Average of 2.25 (range of 1.00 to 4.66). |



Table 3.1-d. Bonshaw ACT01 Zone 4 results summary

| | ACT01 Zone 4 |
|-------------------------|--|
| Description | This zone is dominated by exotic vegetation. The low-lying areas of the zone are dominated by Phalaris, and other areas support a mix of Phalaris, Cocksfoot <i>Dactylis glomerata</i> , broadleaf weeds, and exotic annuals. The scattered stock camps are dominated by Barley grasses <i>Hordeum</i> sp. and exotic broadleaf weeds. |
| Size | 41.81 ha (4 plots and 4 transects). |
| Native Species Richness | 0-6 total native species, 0-3 native non-grass species, 0 indicator species. |
| Exotic Species Richness | 4-22 species. |
| Significant Weeds | Phalaris, Paspalum, Tall Fescue and African Lovegrass, with a low to high combined cover (less than 5% up to 75%). St John's Wort, Saffron Thistle and Scotch Thistle <i>Onopodum acanthium</i> also present. |
| WVS | Average of 9.51 (range of 4.30 to 15.51). |
| FVS | Average of 0.87 (range of 0 to 1.62). |



3.1.2 Discussion and comparison to previous mapping

Discussion and recommendations to improve grassland quality

No evidence of widespread cultivation or pasture improvement is present in Bonshaw, however the site has been used for sheep and cattle grazing under rural lease for many years (lessee Mark Margules pers. comm.). Whilst stock have been rotated between paddocks to allow the grassland/pasture to recover, this rotation has been applied with a primarily pastoral productivity focus rather than a grassland conservation focus. It was observed during this study that many of the forbs within the site were grazed to ground during the spring flowering season, which will largely prevent the reproduction of these species. This grazing regime has likely led to the current mapping of the majority of the site as Zone 3 (i.e. grassland with native dominance but low floristic diversity). The other key management priority for the site is the control of noxious weeds, notably Serrated Tussock.

It is recommended that a conservation-targeted management plan be prepared which prescribes a management regime for the site. This management regime should stipulate the stocking rates, rotational grazing, targeted weed control works, and other focused measures that will be applied to protect and enhance the grassland conservation values of the site.

Comparison to previous mapping

Umwelt (2016⁹) completed a series of ecological surveys throughout Bonshaw across spring 2014 and 2015, which included assessment and mapping of the vegetation quality and extent. The vegetation assessment applied the methods detailed in ACT Government (2015c¹⁰), including assessment of the grassland floristic diversity using the revised Floristic Value Score method (Rehwinkel 2015). As illustrated in Figure 3.1 and noted in Table 3.15 of the Umwelt report, 183 ha of the site was assessed as supporting PCT-ACT01 in moderate/good condition and was therefore deemed to constitute EPBC Act NTG-SEH. The Umwelt study applied the methods detailed in ACT Government (2015c) in a logical, albeit overly literal, manner. The Umwelt study also provides a useful comparison between the previous FVS method (Rehwinkel 2007¹¹) and the revised method (Rehwinkel 2015). Notwithstanding this, the following are important points of comparison between the Umwelt mapping and that prepared by this study.

1. Umwelt identified only two vegetation mapping units, one native dominant and one exotic dominant. The exotic mapping unit was not assessed, and the native mapping unit was assessed as a single homogenous unit via placement of the floristic survey plots generally in locations with the highest floristic diversity. The data recorded from this approach when considered against the EPBC Act NTG-SEH criteria resulted in Umwelt's mapping of the entire 183 ha of the site as the listed TEC. As illustrated in the current mapping, the site supports four distinct vegetation zones, one exotic and three native. Dividing the native vegetation into separate vegetation zones based on native floristic diversity provides a far more accurate means of determining the actual area of the site with the floristic characteristics sufficient to be reasonably considered EPBC Act NTG-SEH. Zone 3 is characterised by very low forb diversity and should not be considered to constitute the TEC.

⁹ Umwelt (2016). *Bonshaw Ecological Survey*. Prepared for the ACT Land Development Agency. March 2016.

¹⁰ ACT Government (2015c). *ACT Environmental Offsets Calculator Operational Manual*.

¹¹ Rehwinkel (2007). *A Method to Assess Grassy Ecosystem Sites: Using Floristic Information to Assess a Site's Quality*. NSW Department of Environment and Climate Change, November 2007 (Version 2).

2. The Umwelt grassland assessment and mapping was completed at a broad scale and thus provided a lower degree of accuracy to that of the four-step method employed for this study. The field delineation and corresponding GIS mapping undertaken to map the vegetation zones for this study was completed with the objective of producing a highly accurate and fine-scale map of the vegetation within the site. For this reason alone, it is difficult to directly compare the mapping outputs.

Figure 3.1-a. Bonshaw Vegetation Mapping Results



Figure 3.1-b. Bonshaw EPBC Act NTG-SEH



Figure 3.1-c. Bonshaw Exotic Vegetation Classification



3.2 Jarramlee

3.2.1 Grassland mapping results

Figure 3.2-a shows the extent of the grassland PCT and zones for Jarramlee, the location of the floristic quality plots and step-point transects, and the associated Floristic Value Scores. The location of the NW corner of each plot and the start/end location of transects are provided in Appendix 1 and 2, respectively.

Jarramlee was found to support one PCT: 'ACT01 Tablelands Dry Tussock Grassland', with the following zones.

- 2.70 ha of Zone 1: Native dominant – High to very high diversity (meeting the EPBC Act criteria for NTG-SEH in 'high to very high condition').
- 4.10 ha of Zone 2: Native dominant – Moderate to high diversity, or with greater than 50% coverage of Kangaroo Grass *Themeda triandra* (meeting the EPBC Act criteria for NTG-SEH in 'moderate to high condition').
- 48.10 ha of Zone 3: Native dominant – Low diversity (not meeting the EPBC Act criteria for NTG-SEH).
- 45.79 ha Zone 4: Exotic dominated – Low diversity.

In total, 6.80 ha of grassland in Jarramlee meets the EPBC Act criteria for NTG-SEH (Figure 3.2-b).

Native species richness ranged from 2 native species (Ja_01.4.4) to 19 native species (Ja_01.1.1). These two plots also set the range for FVS, which varied from 0.40 (Ja_01.4.4) to 24.32 (Ja_01.1.1).

Figure 3.2-c shows the exotic dominance categories for Jarramlee. The exotic areas were mainly classified as 'Noxious Weed Species' (notably Chilean Needle Grass) or 'Pasture and Agricultural Weed Species', with a few 'Stock Camps' located within the site.

Significant weeds were found throughout the site, including Chilean Needle Grass (Zones 1, 3 and 4), Paspalum (all zones), Tall Fescue (all zones), Phalaris (Zones 2-4), African Lovegrass (Zones 3 and 4) and Serrated Tussock (Zone 3). Other pest plants that were widespread include St John's Wort, Paterson's Curse *Echium plantagineum*, Saffron Thistle, Briar Rose *Rosa rubiginosa* and Blackberry *Rubus fruticosus*.

One endangered species, Hoary Sunray *Leucochrysum albicans* var. *tricolor*, was recorded in the south-west of the site¹². This species was located in Zone 3, but not within any of the floristic quality plots. Many Golden Sun Moths were also observed within the site, primarily associated with Chilean Needle Grass dominated areas of the Ginninderra Creek floodplain, and one White-winged triller *Lalage sueurii* was observed in the east of the site¹³.

Tables 3.2a-3.2d provide summaries of the plot results for each zone. Detailed summaries of the floristics and step-point transects for each plot are provided in Appendix 1 and 2, respectively.

¹² <http://canberra.naturemapr.org/Community/Sighting/3385156>

¹³ UTM 682628 6103260

Table 3.2-a. Jarramlee ACT01 Zone 1 results summary

| | ACT01 Zone 1 |
|-------------------------|--|
| Description | NTG-SEH. Native-dominated (Themeda/Austrostipa/Rytidosperma association), supporting a high to very high diversity of native grass and forb species. |
| Size | 2.70 ha (4 plots and 4 transects). |
| Native Species Richness | 12-19 total native species, 4-11 native non-grass species, 4-8 indicator species. |
| Exotic Species Richness | 10-16 species. |
| Significant Weeds | Chilean Needle Grass and Paspalum, with a low combined cover (less than 5%). St John's Wort, Paterson's Curse, Saffron Thistle, Briar Rose, Blackberry and Aaron's Rod also present. |
| WVS | Average of 8.00 (range of 5.12 to 12.03). |
| FVS | Average of 20.26 (range of 16.69 to 24.32). |



Table 3.2-b. Jarramlee ACT01 Zone 2 results summary

| | ACT01 Zone 2 |
|--------------------------------|--|
| Description | NTG-SEH. Native-dominated (Themeda/Bothriochloa association), supporting a moderate to high diversity of native grass and forb species, or with greater than 50% coverage of Kangaroo Grass. |
| Size | 4.10 ha (5 plots and 5 transects). |
| Native Species Richness | 3-11 total native species, 0-4 native non-grass species, 1-3 indicator species. |
| Exotic Species Richness | 7-14 species. |
| Significant Weeds | Paspalum, Phalaris and Tall Fescue, with a low to moderate combined cover (less than 5% up to 25%). St John's Wort, Paterson's Curse, Saffron Thistle, Briar Rose and Blackberry also present. |
| WVS | Average of 7.92 (range of 3.00 to 12.68). |
| FVS | Average of 7.11 (range of 4.75 to 9.62). |

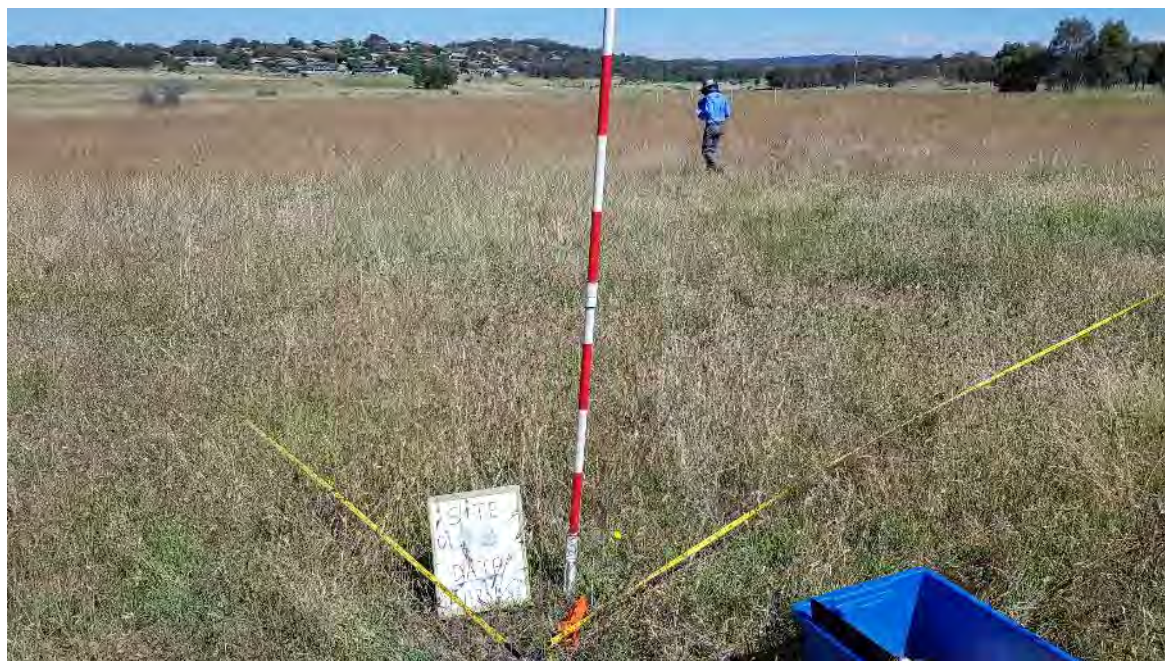


Table 3.2-c. Jarramlee ACT01 Zone 3 results summary

| | ACT01 Zone 3 |
|--------------------------------|---|
| Description | Native grassland. Native-dominated (Austrostipa/Rytidosperma association), with some forbs present. This zone has lower diversity than Zone 1 and Zone 2 and does not meet the EPBC Act criteria for NTG-SEH. |
| Size | 48.10 ha (5 plots and 5 transects). |
| Native Species Richness | 6-10 total native species, 1-3 native non-grass species, 0-4 indicator species. |
| Exotic Species Richness | 11-18 species. |
| Significant Weeds | Paspalum, Serrated Tussock, African Lovegrass, Chilean Needle Grass, Tall Fescue and Phalaris, with a low to moderate combined cover (less than 5% up to 25%). St John's Wort, Paterson's Curse, Saffron Thistle, Briar Rose, Blackberry, Aaron's Rod and Spear Thistle <i>Cirsium vulgare</i> also present. |
| WVS | Average of 12.44 (range of 6.07 to 18.27). |
| FVS | Average of 4.48 (range of 1.80 to 10.08). One plot had a FVS significantly above 6.5, which is higher than usually expected within low diversity native grassland. This plot (Ja_01.3.2, FVS = 10.08) is in an area of native pasture dominated by <i>Themeda triandra</i> and <i>Austrostipa bigeniculata</i> . The high FVS can be attributed to several species which receive a 'Significance Rating' which may be too high. This is discussed further in Section 4 – Conclusion. |

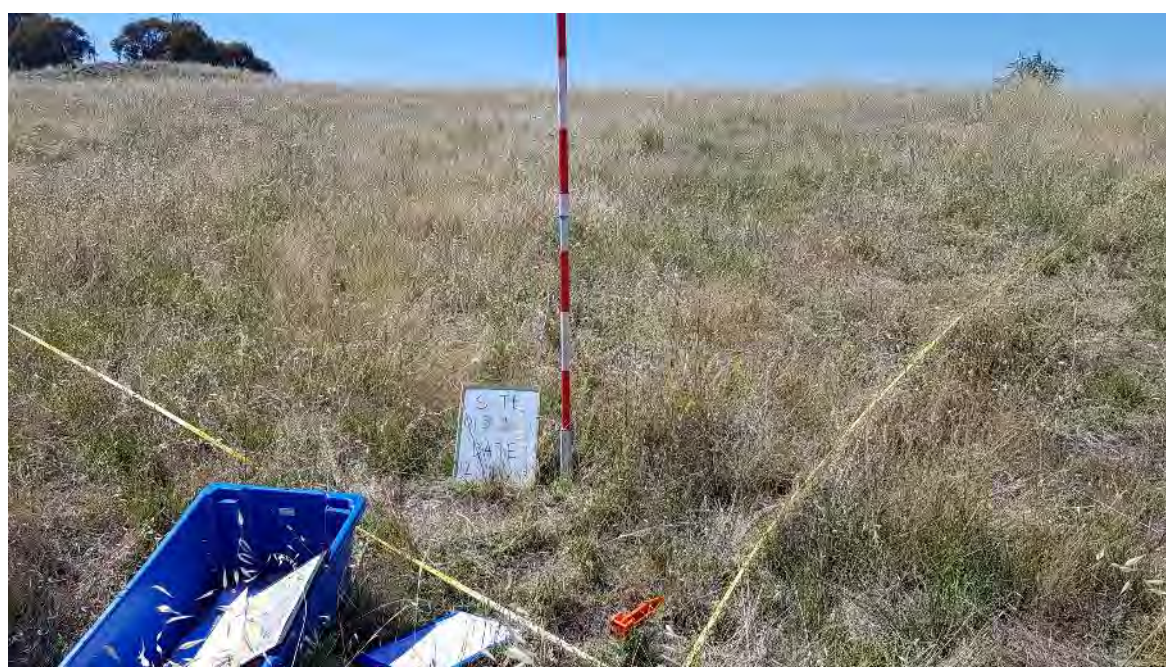


Table 3.2-d. Jarramlee ACT01 Zone 4 results summary

| | ACT01 Zone 4 |
|-------------------------|--|
| Description | This zone is dominated by exotic vegetation. The low-lying areas (notably the flood plain of Ginninderra Creek) are dominated by Chilean Needle Grass. The other areas support a mix of Phalaris, Cocksfoot, broadleaf weeds, and exotic annuals. The scattered stock camps are dominated by Barley grass, Cocksfoot and exotic broadleaf weeds. |
| Size | 45.79 ha (5 plots and 5 transects). |
| Native Species Richness | 2-8 total native species, 0-6 native non-grass species, 0-3 indicator species. |
| Exotic Species Richness | 13-20 species. |
| Significant Weeds | Chilean Needle Grass, Paspalum, Phalaris, Tall Fescue and African Lovegrass, with a moderate to high combined cover (25% to 75%). Saffron Thistle, Paterson's Curse, St John's Wort, Blackberry and Scotch Thistle also present. |
| WVS | Average of 15.93 (range of 12.97 to 18.72). |
| FVS | Average of 1.69 (range of 0.40 to 5.17). |



3.2.2 Discussion and comparison to previous mapping

Discussion and recommendations to improve grassland quality

The vegetation quality is highly varied within Jarramlee, ranging from the expanses of monoculture Chilean Needle Grass occurring across the Ginninderra Creek floodplain to the small but floristically diverse and Kangaroo Grass dominated patches of NTG-SEH located upslope. The vegetation quality and extent is a direct result of both the varied land use history of the site and the more recent and ongoing intensive weed introduction source posed by Ginninderra Creek. As illustrated in Figure 3.2-d, the floristically significant areas of the site consist of numerous small patches generally associated with the rocky outcrops and other areas occurring above the Ginninderra Creek floodplain which were not ripped and planted to eucalypt trees in circa 1972-74. The large rocky outcrops would have prevented ripping and the subsequent shading and other impacts from tree planting and would likely have decreased the grazing pressure and nutrification from stock (sheep, cattle and horses), which tend to avoid such areas.

As shown in Figure 3.2-c, Jarramlee contains numerous small 'Stock Camps' dominated by annual grass and herbaceous weed species, together with substantial areas of 'Pasture and Agricultural Species' (notably *Phalaris* and Tall Fescue). However, it is the Chilean Needle Grass occurring throughout the Ginninderra Creek floodplain that poses the greatest threat to the site's remaining patches of NTG-SEH and expanses of Tall Speargrass dominated low diversity native grassland (ACT01 Zone 3). Whilst not yet a dominant species in ACT01 Zones 1-3, Chilean Needle Grass does occur as individual plants or small patches throughout these zones. Chilean Needle Grass is not spread by wind, rather its key dispersal vectors are overland waterflows, stock (internally and externally), and potentially native and exotic fauna.

In light of the above, it is recommended that the spread of Chilean Needle Grass into areas above the Ginninderra Creek Floodplain is addressed as a key management priority. This will be best achieved via spot spraying of newly established plants (particularly in the vicinity of NTG-SEH patches), together with controlling stock movements during seed set from heavily infested areas to the cleaner areas upslope (the recently constructed fences are well placed to facilitate this). The Chilean Needle Grass is so well entrenched throughout the floodplain that its eradication or substantial reduction is unlikely to be achievable, particularly given that any treated areas would simply be re-sown with the species during the next flood event. It is also noted that the Chilean Needle Grass dominated floodplain areas now support one of the largest and most densely occupied remaining patches of Golden Sun Moth habitat (Biosis 2014¹⁴), a critically endangered species which is known to feed on Chilean Needle Grass as an alternative to its native feed species (primarily grasses in the genera *Rytidosperma* and *Austrostipa*).

With regard to the above, the 'Jarramlee Offset Management Plan' (ACT Government 2013¹⁵) was prepared as a condition of EPBC Act approval of the establishment of Jarramlee as an offset for impacts from the development of Lawson South. This plan prescribes in detail the measures that must be implemented to protect and enhance the significant grassland and fauna habitat values of the site, including biomass management, riparian restoration, weed control, pest animal control, fencing, and monitoring of the NTG-SEH and GSM habitat. As described in the plan, the site is split into separate broad management units, one focused on protecting the NTG-SEH patches from noxious weed encroachment and expanding patch size, the other focused on retaining the Golden Sun Moth habitat whilst restricting the production of Chilean Needle Grass seed and its spread

¹⁴ Biosis (2015). *Golden Sun Moth Monitoring Report – Jarramlee Nature Reserve*. Prepared for the ACT Parks and Conservation Service. Final 2 February 2015.

¹⁵ ACT Government (2013). *Jarramlee Offset Management Plan*. Territory and Municipal Services.

within the site and into the broader catchment. It is recommended that management of the site continues in accordance with the plan.

Comparison to previous mapping

The grassland throughout Jarramlee (and the adjoining West Macgregor site) was assessed and mapped by Rowell (2013¹⁶). The extent of the site assessed as supporting NTG (as per the pre-2016 EPBC Act listing definition) was a small proportion of that identified in the broad scale mapping undertaken prior to 2005 (ACT Government 2005¹⁷).

SMEC (2016¹⁸) reassessed the quality and extent of the NTG within the site in December 2015, the primary purpose of which was to assess changes relative to the Rowell (2013) mapping, and to collect and report baseline data relating to site condition, vegetation quality and specific habitat characteristics for each of the monitoring plots. SMEC used the assessment method provided in ACT Government (2015a), including determination of FVS applying the Rehwinkel (2007) method. Shown as 'NTG Dry Themeda Association = 1.3 ha' and 'NTG Dry Rytidosperma Association = 2.4 ha' on Figure 2 of that report, a total of 3.7 ha of the site was mapped as NTG. SMEC concluded that their vegetation mapping was relatively consistent with Rowell (2013) with only a few changes to the vegetation communities (i.e. area of NTG 4.8 ha and 3.7 ha respectively). One of the key recommendations was that the vegetation survey and mapping be repeated in spring as it was considered that their surveys may have been limited by the late December timing. This is unlikely to have been a substantial limitation however, given that mid-November to late December is usually the period when greatest floristic diversity is recorded in ACT grasslands.

Based on SMEC's recommendation, Umwelt (2017¹⁹) reassessed the quality and extent of the vegetation throughout the site in November-December 2016. Umwelt also used a method based on that provided in ACT Government (2015a), however the updated method provided in Rehwinkel (2015) was used to determine the extent of NTG-SEH occurrence. Shown as Zone 1 on Figure 3.2 of that report, 11.18 ha of the site was mapped as NTG-SEH. This comprised the rocky outcrops (with substantial buffers) in the southwest extent of the site, together with the large patch of Kangaroo Grass dominated grassland east of Jarramlee Road.

Whilst both SMEC (2016) and Umwelt (2017) undertook the field survey components of their studies in accordance with the method detailed in ACT Government (2015), each interpreted the data gained in a different and somewhat convoluted manner. It is also noted that both SMEC (2016) and Rowell (2013) determined the presence of NTG based on the Rehwinkel (2007) FVS calculation, however Umwelt (2017) made their determinations based on the considerably more easily met Rehwinkel (2015) FVS calculation (the implications of the changed FVS calculation are discussed further in Section 4). The differences in data interpretation and presentation make it difficult to directly compare the mapping from the two studies, however it is likely that the substantially larger area of NTG-SEH mapped by Umwelt (2017) is primarily a reflection of the changed FVS calculation.

¹⁶ Rowell, A. (2013). *Surveys of Natural Temperate Grassland and Golden Sun Moth at Lawson South Offset area, Jarramlee/West Macgregor*. December 2012 to February 2013.

¹⁷ ACT Government (2005). *A Vision Splendid of the Grassy Plains Extended: ACT Lowland Native Grassland Conservation Strategy. Action Plan No. 28*. Canberra: Arts, Heritage and Environment.

¹⁸ SMEC (2016). *Jarramlee Offset – Natural Temperate Grassland and Golden Sun Moth Habitat – 2015 Monitoring Report*. Prepared for ACT Government, Parks and Conservation Service. April 2016.

¹⁹ Umwelt (2017). *Golden Sun Moth Monitoring and Grassland Condition and Extent – Jarramlee Environmental Offset Reserve*. Prepared for the ACT Government, Parks and Conservation Service. Final March 2017.

With a total of 6.8 ha of NTG-SEH (i.e. 2.70 ha of Zone 1 and 4.10 ha of Zone 2), the extent mapped for this study is roughly midway between the 3.7 mapped by SMEC (2016) and the 11.8 ha mapped by Umwelt (2017). In this regard, a comparison between Figure 3.2-a and Figure 2 of SMEC (2016) shows that several of the small polygons of NTG-SEH were not identified as NTG by SMEC, nor was much of the large polygon east of Jarramlee Road. Similarly, a comparison between Figure 3.2-a and Figure 3.2 of Umwelt (2017) shows that substantially more of the area surrounding the rocky outcrops in the southwest extent of the site was identified as NTG-SEH.

Overall, the results of the three recent grassland quality and extent mapping studies undertaken at Jarramlee do not differ substantially. The field-based delineation and GIS mapping of the vegetation zone boundaries by both SMEC (2016) and Umwelt (2017) was undertaken at a considerably broader scale than that applied for this study. This appears to have resulted in SMEC (2016) missing some of the smaller patches and Umwelt (2017) delineating NTG-SEH polygons which are larger than actually occur. Therefore, whilst noting the potential influences of the differences in mapping approach and data interpretation described above, it is likely that the total area of NTG-SEH mapped during this study is midway between that defined in the other studies primarily due to the finer scale and associated higher degree of accuracy of the mapping product.

The paddock located between the Bicentennial Trail and the site's southern boundary was identified during 2015 to pose a threat to public safety due to potential subsidence from the decommissioned and buried former Belconnen Sewage Treatment Plant (refer Figure 3.2-d). The paddock was then fenced with temporary panel fencing and notices erected on the fence stating that access is prohibited to all unauthorised persons. The temporary fence was replaced with a permanent fence at some time prior to November 2017. Due to the lack of access:

- SMEC (2016) mapped the paddock as 'Native Pasture Wallaby Grass/Spear Grass' based on observations from the fence; and
- Umwelt (2017) excluded the paddock from their mapping, however described the vegetation within as Mixed Grassland based on observations from the fence.

The paddock was excluded from the site and not assessed and mapped for this study, primarily because the four-step mapping method cannot be applied without on-ground boundary delineation and data collection. Nevertheless, based on observations from the fence during this study, those made by SMEC (2016) and Umwelt (2017), and previous observations of Golden Sun Moth habitat characteristics (R. Speirs pers. obs.), it is expected that the site would be mapped as supporting areas of ACT01 Zone 3 (low diversity native grassland) and ACT01 Zone 4 (exotic).

Figure 3.2-a. Jarramlee and West Macgregor Vegetation Mapping Results

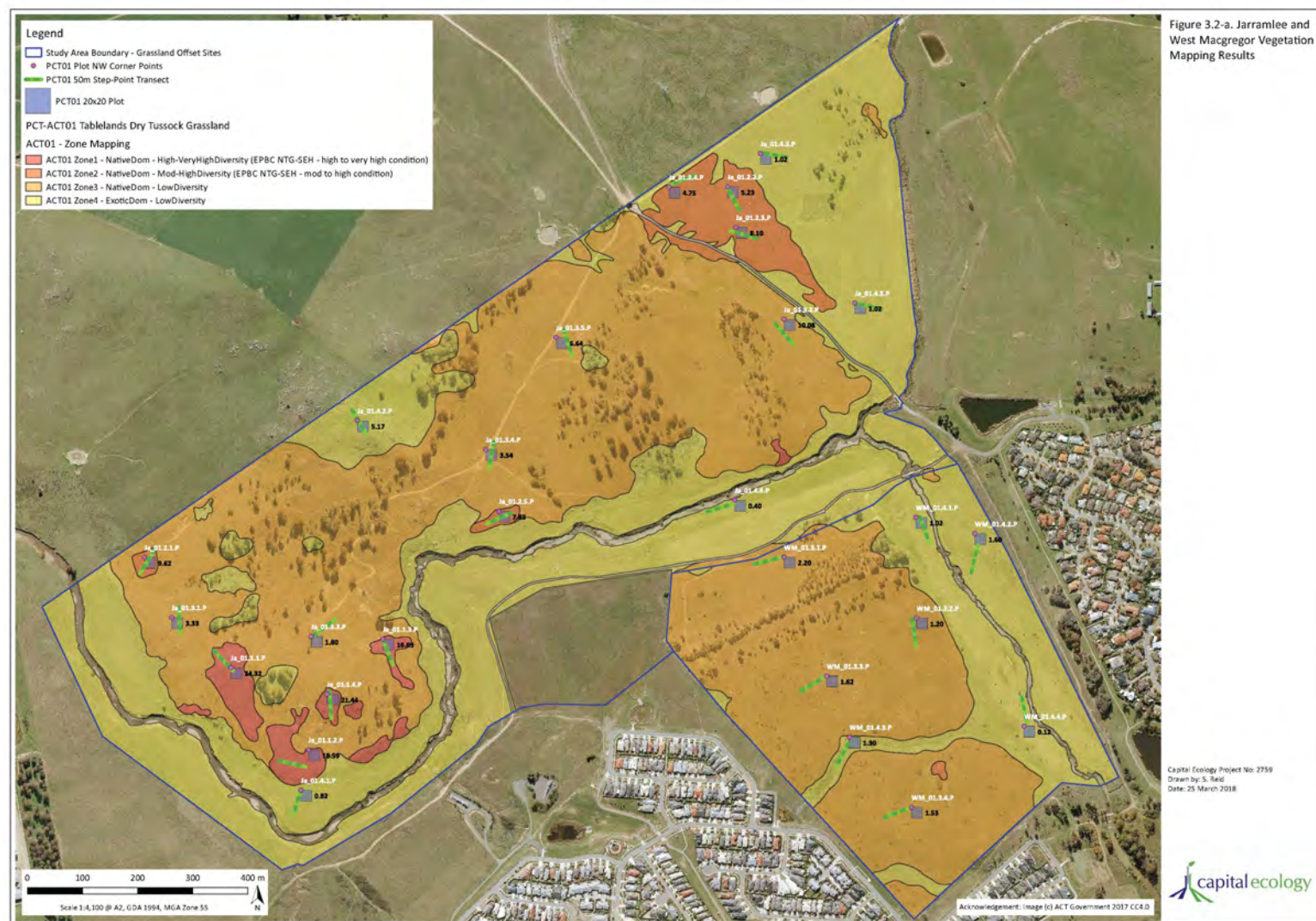


Figure 3.2-b. Jarramlee and West Macgregor EPBC Act NTG-SHE



Figure 3.2-c. Jarramlee and West Macgregor Exotic Vegetation Classification



Figure 3.2-d. Jarramlee EPBC Act NTG-SEH on 1975 Aerial Photograph



3.3 Kenny Grassland

3.3.1 Grassland mapping results

Figure 3.3-a shows the extent of the grassland PCT and zones for Kenny Grassland, the location of the floristic quality plots and step-point transects, and the associated Floristic Value Scores. The location of the NW corner of each plot and the start/end location of transects are provided in Appendix 1 and 2, respectively.

Kenny Grassland was found to support one PCT: 'ACT01 Tablelands Dry Tussock Grassland', with the following zones.

- 15.48 ha of Zone 3: Native dominant – Low diversity (not meeting the EPBC Act criteria for NTG-SEH).
- 41.12 ha Zone 4: Exotic dominated – Low diversity.

Kenny Grassland does not support any areas which meet the EPBC Act criteria for NTG-SEH.

Native species richness ranged from 3 native species (KG_01.4.2) to 6 native species (KG_01.3.4). The FVS varied from 0.72 (Je_01.4.2) to 2.01 (Je_01.3.2).

Figure 3.3-b shows the exotic dominance categories for Kenny Grassland. The majority of the exotic areas were classified as 'Pasture and Agricultural Weed Species', with only one 'Stock Camp' located within the site. Some areas contained a significant density of Serrated Tussock plants but were still dominated by exotic pasture and thus classified as such.

Significant weeds were found throughout the site, including Serrated Tussock (all zones), African Lovegrass (all zones), Phalaris (all zones) and Paspalum (all zones). Other pest plants that were widespread include Paterson's Curse, Saffron Thistle and Scotch Thistle.

No threatened or rare species were recorded.

Tables 3.3a-3.3b provide summaries of the plot results for each zone. Detailed summaries of the floristics and step-point transects for each plot are provided in Appendix 1 and 2, respectively.

Table 3.3-a. Kenny Grassland ACT01 Zone 3 results summary

| | ACT01 Zone 3 |
|--------------------------------|--|
| Description | Native grassland. Native-dominated (Austrostipa association), with some forbs present. This zone has low diversity and does not meet the EPBC Act criteria for NTG-SEH. Parts of Zone 3 contain a significant number of Serrated Tussock plants. |
| Size | 15.48 ha (4 plots and 4 transects). |
| Native Species Richness | 4-6 total native species, 0-2 native non-grass species, 0-1 indicator species. |
| Exotic Species Richness | 7-9 species. |
| Significant Weeds | Serrated Tussock, African Lovegrass, Phalaris and Paspalum, with a moderate combined cover (up to 25%). Paterson's Curse, Scotch Thistle, Saffron Thistle and St John's Wort also present. |
| WVS | Average of 9.34 (range of 4.40 to 12.59). |
| FVS | Average of 1.56 (range of 1.32 to 2.01). |



Table 3.3-b. Kenny Grassland ACT01 Zone 4 results summary

| | ACT01 Zone 4 |
|--------------------------------|--|
| Description | This zone is dominated by exotic vegetation, largely by Phalaris. Parts of Zone 4 also contain a significant number of Serrated Tussock plants. |
| Size | 41.12 ha (4 plots and 4 transects). |
| Native Species Richness | 3-4 total native species, 0-1 native non-grass species, 0 indicator species. |
| Exotic Species Richness | 6-16 species. |
| Significant Weeds | Serrated Tussock, African Lovegrass, Phalaris and Paspalum, with a moderate to very high combined cover (25% to greater than 75%). Paterson's Curse and St John's Wort also present. |
| WVS | Average of 11.50 (range of 6.59 to 15.58). |
| FVS | Average of 0.99 (range of 0.72 to 1.20). |



3.3.2 Discussion and comparison to previous mapping

Discussion and recommendations to improve grassland quality

Much of Kenny Grassland has undergone a history of prolonged and intensive pasture improvement via the sowing of Phalaris and addition of superphosphate (R. Speirs 2010 discussion with former lessee, John McKinnon). This pasture improvement, together with a history of low-intensity cattle grazing under a set-stocking arrangement, has undoubtedly encouraged the dominance of native and exotic tussock-forming grasses, and led to the loss of all but the most disturbance tolerant native forbs from the site. The areas of native dominance (PCT01 Zone 3) are generally associated with the higher elevated ridges. The drainage lines and Sullivan's Creek floodplain support Phalaris dominated exotic pasture (PCT01 Zone 4). Serrated Tussock occurred in only scattered patches and at only low density in Kenny Grassland in 2010-11 (R. Speirs pers. obs.), however it has since spread throughout much of the site. The Serrated Tussock was not found to thus far occur at a density that warranted classification of areas of PCT01 Zone 4 as 'Noxious Weed Species' dominance (refer Table 2.1-a), although it was recorded as a substantial component of each Step-Point Transect. The Serrated Tussock infestation throughout the Kenny Grassland is now the foremost threat to the significant biodiversity values of the site (notably to Striped Legless Lizard habitat value).

It is highly unlikely that the floristic diversity of the site would increase substantially under any change in land management. Notwithstanding this, Kenny Grassland is one of the largest and most densely occupied remaining patches of Striped Legless Lizard habitat (Biosis Research 2012²⁰), a species for which floristic diversity appears to be of little consequence for habitat suitability or carrying capacity. As such, the grassland/pasture within the site should be protected with the aim of maximising its quality and resilience as Striped Legless Lizard habitat.

With regard to the above, it is recommended that a conservation-targeted management plan be prepared which prescribes a management regime for the site. This management regime should stipulate the stocking rates, rotational grazing, targeted weed control works, and other focused measures that will be applied to protect and enhance the threatened grassland fauna habitat values of the site.

Comparison to previous mapping

The structure and floristic composition of the vegetation within Kenny Grassland was broadly assessed and mapped by Biosis Research (2011²¹), the primary purpose of which was to determine the parts of the study area which possess the grassland attributes of potential habitat for the Striped Legless Lizard. Section 4.1.1.2 of the Biosis report provides a detailed description of the vegetation type and quality within the site as observed during spring 2010, this being categorised as either 'Native Pasture' or 'Exotic Pasture – Tussock Formation Present'. Consistent with the purpose of the Biosis study, the vegetation assessment was based on observations only (i.e. no data collection) and the mapping was prepared at a very broad scale. Notwithstanding this, Biosis' categorisation of the vegetation quality within the site is quite similar to that of this study (i.e. 'Native Pasture' ~ ACT01 Zone 3; 'Exotic Pasture – Tussock Formation Present' ~ ACT01 Zone 4).

²⁰ Biosis Research (2012). *Kenny and Throsby – Striped Legless Lizard (Delma impar) Survey Report*. Author: R. Speirs. Unpublished report to the ACT Government.

²¹ Biosis Research (2011). *Kenny – Striped Legless Lizard (Delma impar) Survey Report*. Author: R. Speirs. Unpublished report to the ACT Government.

Figure 3.3-a. Kenny Grassland Vegetation Mapping Results

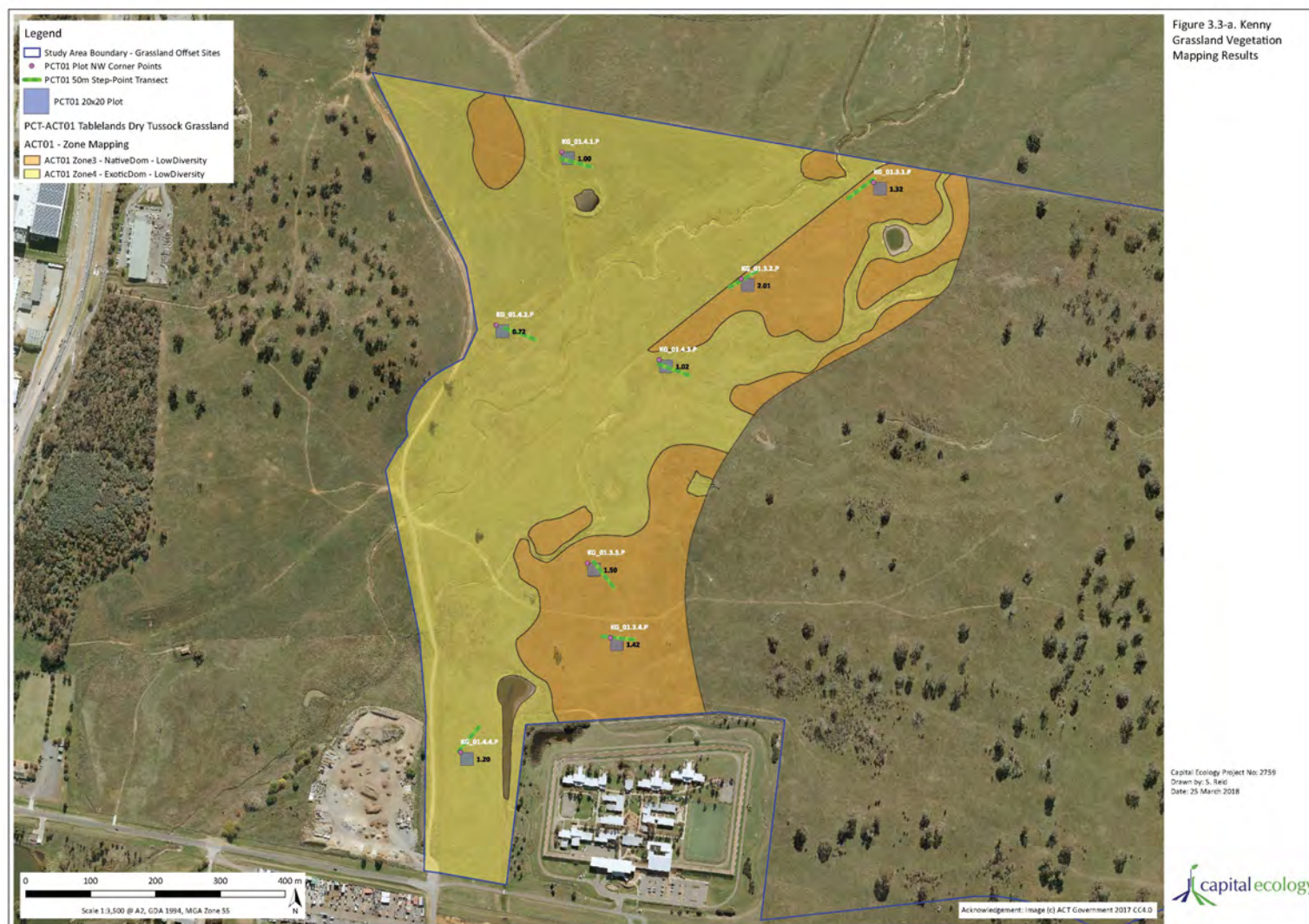
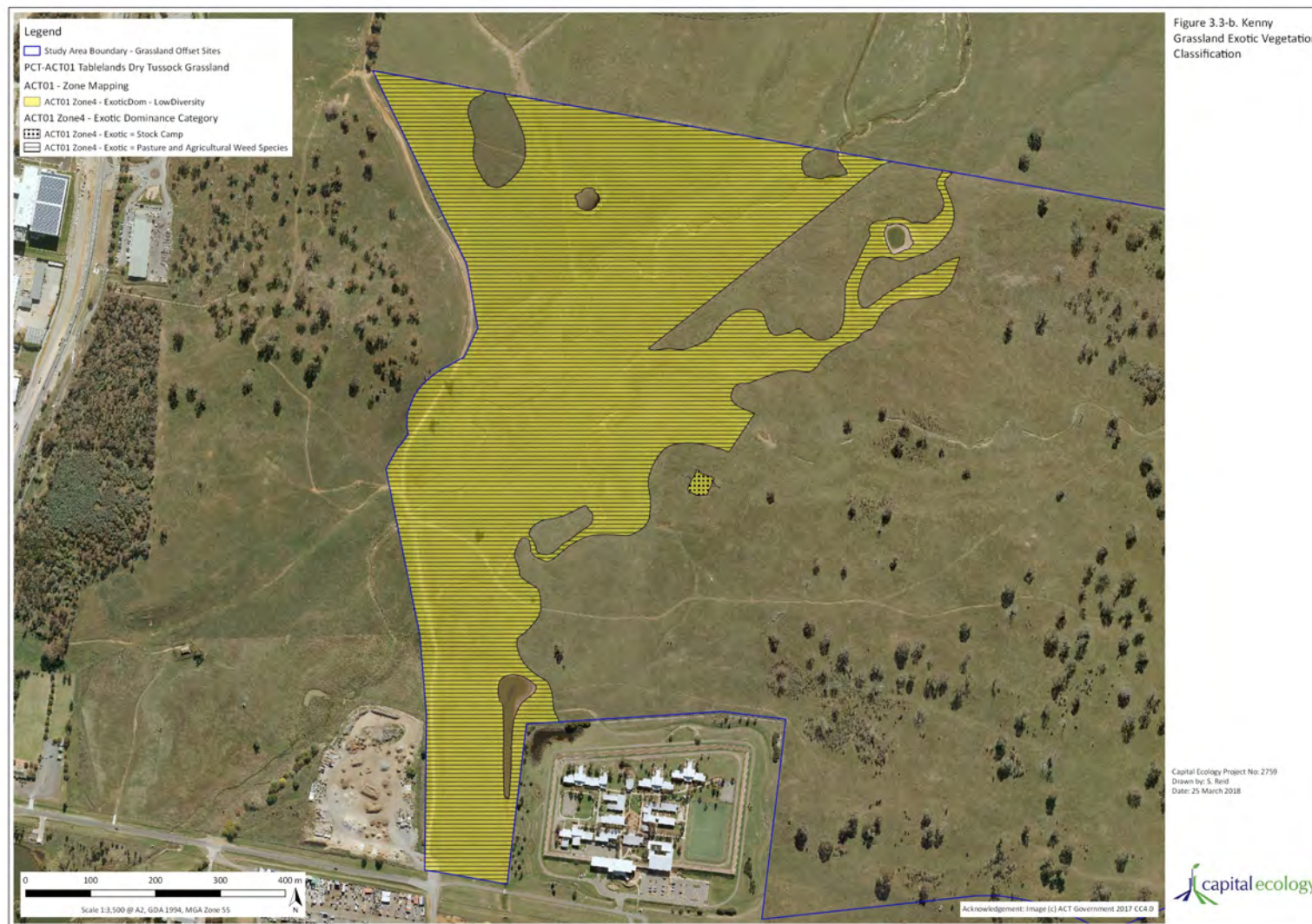


Figure 3.3-b. Kenny Grassland Exotic Vegetation Classification



3.4 Majura West Grassland

3.4.1 Grassland mapping results

Figure 3.4-a shows the extent of the grassland PCT and zones for Majura West Grassland, the location of the floristic quality plots and step-point transects, and the associated Floristic Value Scores. The location of the NW corner of each plot and the start/end location of transects are provided in Appendix 1 and 2, respectively.

Majura West Grassland was found to support one PCT: 'ACT01 Tablelands Dry Tussock Grassland', with the following zones.

- 16.33 ha of Zone 1: Native dominant – High to very high diversity (meeting the EPBC Act criteria for NTG-SEH in 'high to very high condition').
- 1.96 ha of Zone 2: Native dominant – Moderate to high diversity (meeting the EPBC Act criteria for NTG-SEH in 'moderate to high condition').
- 41.97 ha of Zone 3: Native dominant – Low diversity (not meeting the EPBC Act criteria for NTG-SEH).
- 35.19 ha Zone 4: Exotic dominated – Low diversity.

In total, 18.29 ha of grassland in Majura West Grassland meets the EPBC Act criteria for NTG-SEH (Figure 3.4-b).

Native species richness ranged from 2 native species (MW_01.4.1) to 20 native species (MW_01.1.2). These two plots also set the range for FVS, which varied from 0.60 (MW_01.4.1) to 29.47 (MW_01.1.2).

Figure 3.4-c shows the exotic dominance categories for Majura West Grassland. The majority of the exotic areas were classified as 'Pasture and Agricultural Weed Species'. Some areas are dominated by Chilean Needle Grass and thus are classified as 'Noxious Weed Species'.

Significant weeds were found throughout the site, including Serrated Tussock (all zones), Chilean Needle Grass (Zones 3 and 4), Phalaris (Zones 3 and 4) and Tall Fescue (Zone 4). Other pest plants that were widespread include St John's Wort, Saffron Thistle, Briar Rose and Spear Thistle.

No threatened or rare species were recorded.

Tables 3.4a-3.4d provide summaries of the plot results for each zone. Detailed summaries of the floristics and step-point transects for each plot are provided in Appendix 1 and 2, respectively.

Table 3.4-a. Majura West Grassland ACT01 Zone 1 results summary

| | ACT01 Zone 1 |
|-------------------------|---|
| Description | NTG-SEH. Native-dominated (Austrostipa/Rytidosperma/Bothriochloa association), supporting a high to very high diversity of native grass and forb species. |
| Size | 16.33 ha (4 plots and 4 transects). |
| Native Species Richness | 15-20 total native species, 9-15 native non-grass species, 6-8 indicator species. |
| Exotic Species Richness | 5-7 species. |
| Significant Weeds | Serrated Tussock, with a low combined cover (less than 5%). St John's Wort and Saffron Thistle also present. |
| WVS | Average of 4.82 (range of 2.30 to 7.93). |
| FVS | Average of 24.45 (range of 21.66 to 29.47). |

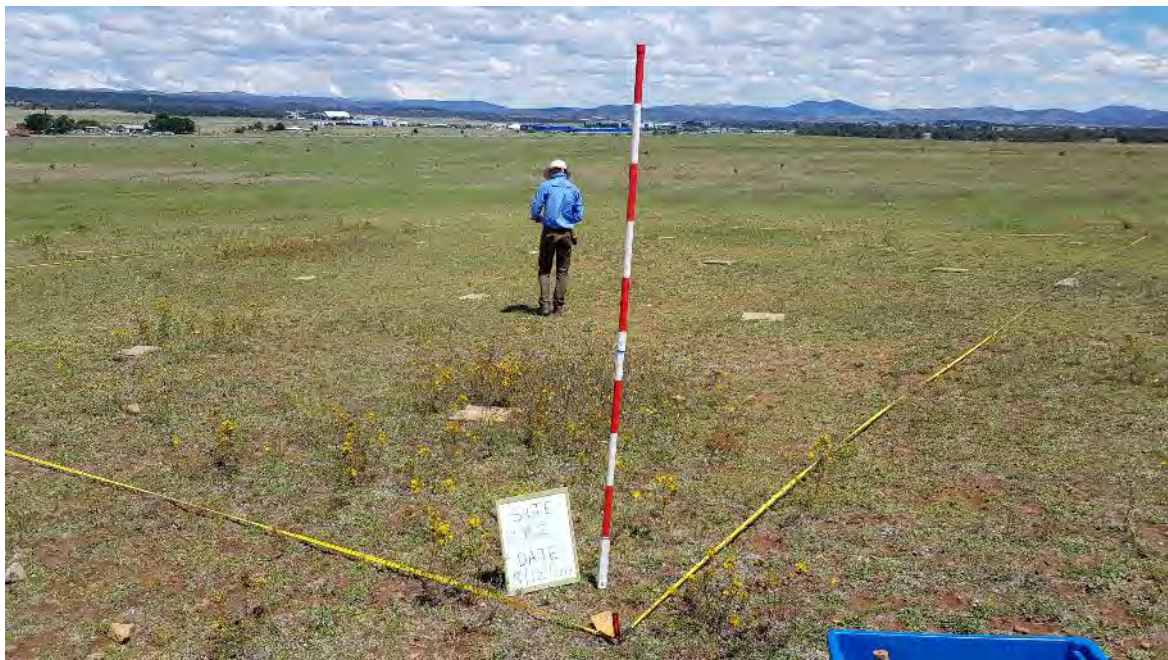


Table 3.4-b. Majura West Grassland ACT01 Zone 2 results summary

| | ACT01 Zone 2 |
|--------------------------------|--|
| Description | NTG-SEH. Native-dominated (Austrostipa/Rytidosperma association), supporting a moderate to high diversity of native grass and forb species. |
| Size | 1.96 ha (2 plots and 2 transects). |
| Native Species Richness | 12-14 total native species, 4-7 native non-grass species, 2-3 indicator species. |
| Exotic Species Richness | 5-9 species. |
| Significant Weeds | Serrated Tussock, with a low combined cover (less than 5%). St John's Wort, Saffron Thistle, Briar Rose and Spear Thistle also present. |
| WVS | Average of 5.32 (range of 4.30 to 6.34). |
| FVS | Average of 8.83 (range of 7.88 to 9.78). Both plots had a FVS above 6.5, which is higher than usually expected within moderate diversity native grassland. The high FVS can be attributed to several species which receive a 'Significance Rating' which may to be too high. This is discussed further in Section 4 – Conclusion. |

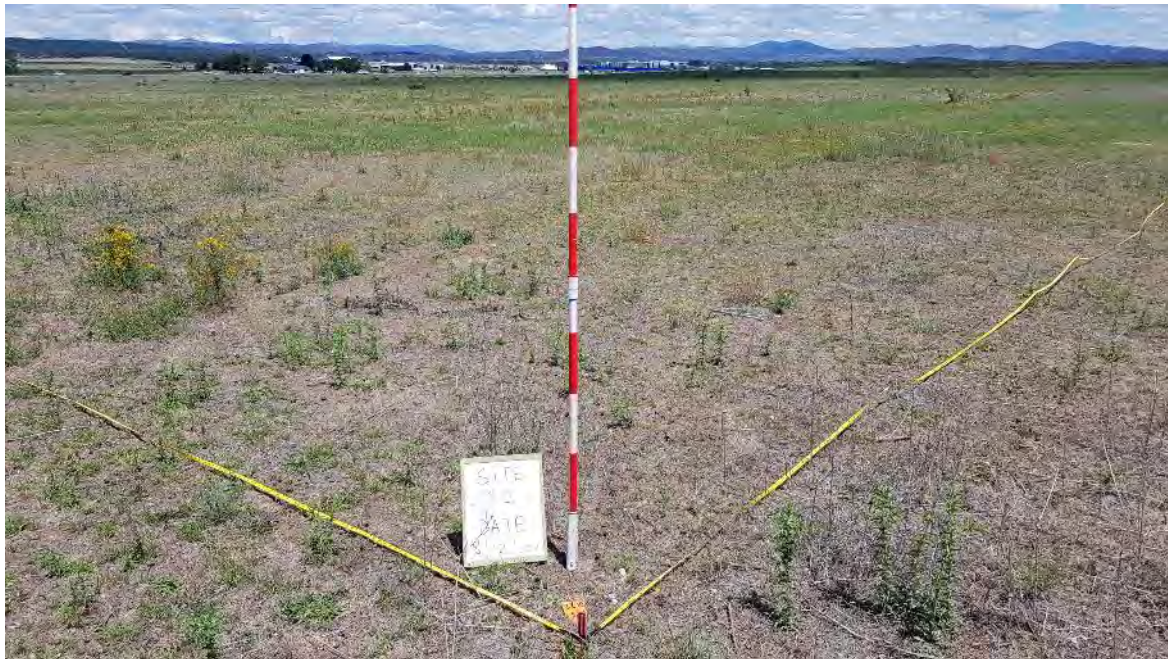


Table 3.4-c. Majura West Grassland ACT01 Zone 3 results summary

| | ACT01 Zone 3 |
|--------------------------------|---|
| Description | Native grassland. Native-dominated (Austrostipa/Rytidosperma association), with some forbs present. This zone has lower diversity than Zone 1 and Zone 2 and does not meet the EPBC Act criteria for NTG-SEH. |
| Size | 41.97 ha (4 plots and 4 transects). |
| Native Species Richness | 6-10 total native species, 3-5 native non-grass species, 0-2 indicator species. |
| Exotic Species Richness | 6-10 species. |
| Significant Weeds | Serrated Tussock, Chilean Needle Grass and Phalaris, with a low combined cover (less than 5%). St John's Wort, Saffron Thistle, Briar Rose, and Spear Thistle also present. |
| WVS | Average of 9.92 (range of 6.26 to 12.92). |
| FVS | Average of 3.20 (range of 2.68 to 3.78). |



Table 3.4-d. Majura West Grassland ACT01 Zone 4 results summary

| | ACT01 Zone 4 |
|--------------------------------|---|
| Description | This zone is dominated by exotic vegetation. The majority of the zone is dominated by Phalaris, and other areas support a mix of Phalaris, Cocksfoot, broadleaf weeds, and exotic annuals. The low-lying areas bordering watercourses in the south of the site are dominated by Chilean Needle Grass. The southern areas also contain a high density of Serrated Tussock. |
| Size | 35.19 ha (4 plots and 4 transects). |
| Native Species Richness | 2-6 total native species, 1-5 native non-grass species, 0-1 indicator species. |
| Exotic Species Richness | 5-15 species. |
| Significant Weeds | Phalaris, Serrated Tussock, Chilean Needle Grass and Tall Fescue, with a moderate to high combined cover (25% to 75%). St John's Wort, Saffron Thistle, Spear Thistle, Briar Rose and Starthistle <i>Centaurea calcitrapa</i> also present. |
| WVS | Average of 10.72 (range of 4.60 to 16.79). |
| FVS | Average of 2.09 (range of 0.60 to 3.31). |



3.4.2 Discussion and comparison to previous mapping

Discussion and recommendations to improve grassland quality

The vegetation condition is highly varied within Majura West Grassland and includes a drainage line dominated by Chilean Needle Grass in the south, Phalaris dominated exotic pasture in the other low-lying areas, large expanses of floristically non-diverse and weedy native pasture, and significant areas of floristically diverse Spear Grass/Wallaby Grass dominated NTG-SEH. Of the sites included in the study, Majura West Grassland contains the greatest area of NTG-SEH (18.29 ha) and is a highly significant grassland site in the ACT. The current condition and extent of the vegetation within the site reflects the long grazing history of the site, together with the recent inadequate site management (i.e. the site has been managed in an ad-hoc manner by the ACT Government for at least the last ten years). This has resulted in the proliferation of weeds such as St John's Wort and Saffron Thistle across the site, and the establishment of significant noxious weeds such as Serrated Tussock and Chilean Needle Grass in the south. As illustrated in Figure 3.4-a, the floristically significant areas of the site are largely restricted to the southern portion and to the elevated drier areas in the west.

As shown in Figure 3.4-c, Majura West Grassland contains substantial areas of 'Pasture and Agricultural Species' (notably Phalaris, Clovers and other exotic forbs). However, it is the significant noxious weeds in the south of the site (particularly Serrated Tussock and Chilean Needle Grass) and the prevalent St John's Wort and Saffron Thistle which pose the greatest threat to the site's remaining patches of NTG-SEH. Serrated Tussock seed is spread by the wind, and large expanses of unmanaged Serrated Tussock in the adjoining land managed by the Commonwealth Department of Defence provides a substantial and continual source of viable seed. St John's Wort and Saffron Thistle seed can remain dormant in the soil for extended periods (to 8 years for Saffron Thistle and >10 years for St John's Wort) and have likely proliferated unhindered due to the removal of stock from the site and subsequent inadequate site management.

In light of the above, it is recommended that the spread of Serrated Tussock from the south is addressed as a key management priority. This will be best achieved via spot spraying of newly established plants (particularly in the vicinity of NTG-SEH patches), and through the coordination of management actions with those responsible for the Defence land to the south. In addition, it is recommended that the control of other notable woody (e.g. Blackberry and Briar Rose) and non-woody weeds (e.g. St John's Wort and Saffron Thistle) be addressed as another key management priority. This will be best achieved by spraying of woody weeds and appropriately timed intensive grazing of non-woody weeds by sheep/goats in low diversity areas, and by ecological burns in high diversity areas. These management actions are likely to require the installation of additional infrastructure (e.g. fences, water points).

With regard to the above, it is recommended that a conservation-targeted management plan be prepared which prescribes a management regime for the site. This management regime should stipulate the stocking rates, stocking timing, and other focused measures that will be applied to protect and enhance the NTG-SEH and other habitat values of the site.

Comparison to previous mapping

The grassland throughout Majura West was assessed and mapped by Biosis (2012) through classification and mapping of the vegetation within the site applying the 'methodology for classifying lowland grasslands' provided in ACT Government (2010), including determination of FVS applying the Rehwinkel (2007) method. The extent of the site assessed as supporting NTG (as per the pre-2016 EPBC Act listing definition) was roughly half that identified in the current study (8.81 ha

compared to 18.29 ha, refer Section 6.2.8 and Figure 8b of Biosis [2012]). The general location of patches of NTG are the same between the two studies, and it is instead the extent of the patches which differ. These differences are largely due to changes in methodology since 2012, notably the way in which FVS is calculated. Higher FVS are more easily attained using the Rehwinkle (2015) FVS calculation, and the substantially larger area of NTG-SEH mapped in the current study is primarily a reflection this (the implications of the changed FVS calculation are discussed further in Section 4).

In addition, Biosis (2012) mapped a gully in the centre of the site as exotic dominated. This gully was mapped as native pasture (Zone 3) in the current study. Following comments from PCS on a draft of the 2017 mapping (Melita Milner pers. comm.), Capital Ecology ecologists reassessed the gully in March 2018 to determine its status, particularly pertaining to the presence of Chilean Needle Grass. This assessment confirmed the initial 2017 vegetation mapping. While Chilean Needle Grass was indeed present in much of the gully, the tussocks were sparsely distributed and currently occurring in small patches separated by litter, bare ground and scattered tussocks of native grass. Thin strips of Chilean Needle Grass did dominate certain sections of the gully but were not large enough to warrant mapping. It is recommended that this gully be reassessed in 2018 during favourable survey conditions (November to December) to confirm its status.

Overall, the current mapping of vegetation condition and extent is broadly consistent with that prepared by Biosis (2012).

Figure 3.4-a. Majura West Grassland Vegetation Mapping Results

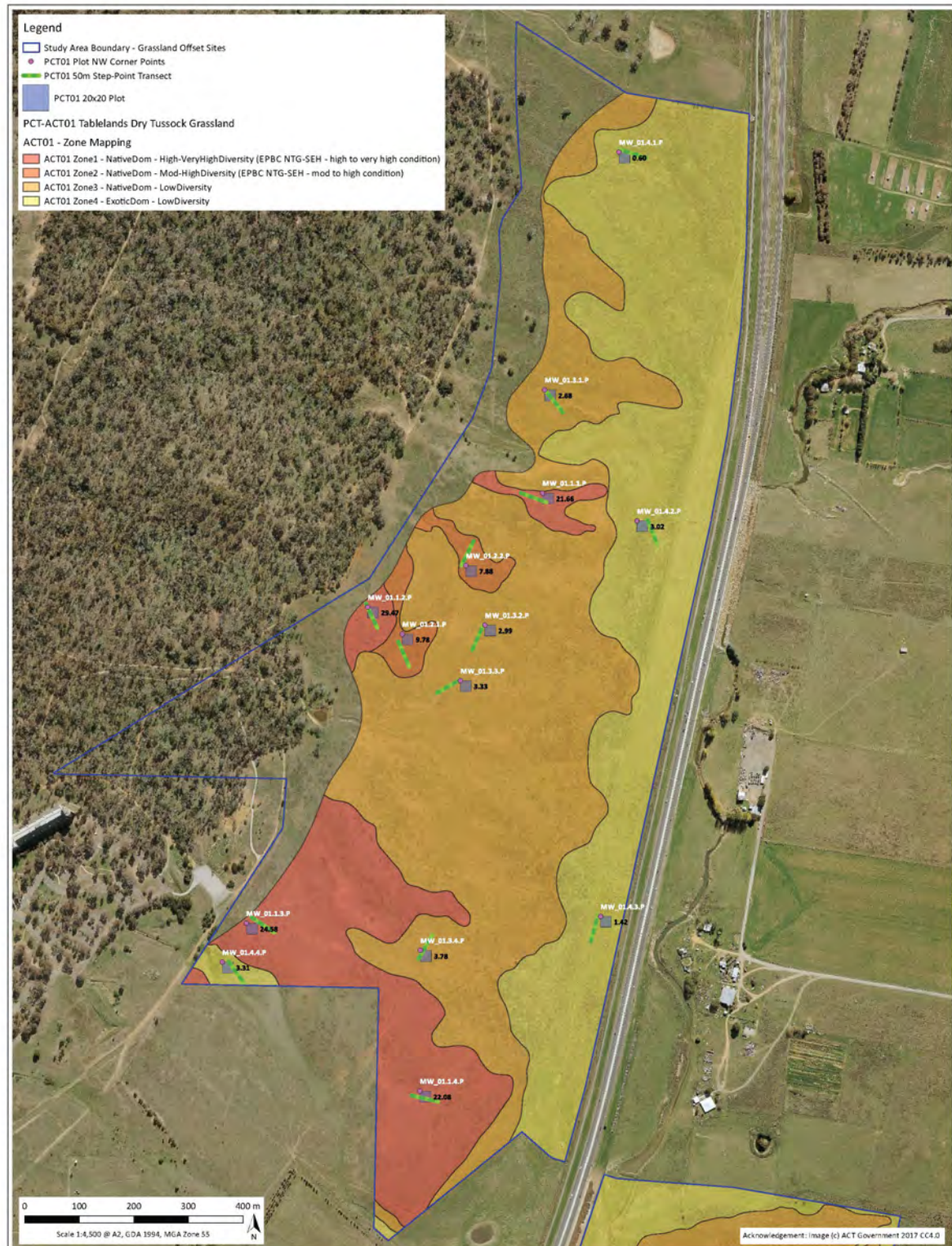


Figure 3.4-a. Majura West Grassland Vegetation Mapping Results

Capital Ecology Project No: 2759
 Drawn by: S. Reid
 Date: 25 March 2018

Figure 3.4-b. Majura West Grassland EPBC Act NTG-SEH



Figure 3.4-b. Majura West Grassland EPBC Act NTG-SEH

Capital Ecology Project No: 2759
Drawn by: S. Reid
Date: 25 March 2018

Figure 3.4-c. Majura West Grassland Exotic Vegetation Classification



3.5 West Macgregor

3.5.1 Grassland mapping results

Figure 3.2-a shows the extent of the grassland PCT and vegetation zones ('zones') for West Macgregor, the location of the floristic quality plots and step-point transects, and the associated Floristic Value Scores. The location of the NW corner of each plot and the start/end location of transects are provided in Appendix 1 and 2, respectively.

West Macgregor was found to support one PCT: 'ACT01 Tablelands Dry Tussock Grassland', with the following zones.

- 0.07 ha of Zone 2: Native dominant – Moderate to high diversity.
- 24.19 ha of Zone 3: Native dominant – Low diversity (not meeting the EPBC Act criteria for NTG-SEH of the South Eastern Highlands).
- 11.77 ha Zone 4: Exotic dominated – Low diversity.

A single small patch (0.07 ha) of grassland in West Macgregor was classified as Zone 2. As this patch was under 0.1 ha in size, it does not meet the EPBC Act criteria for NTG-SEH. A floristic quality plot was not performed in this patch, but the vegetation was dominated by Kangaroo Grass and Spear Grasses and contained a moderate diversity of native forbs.

Native species richness ranged from 1 native species (WM_01.4.4) to 7 native species (WM_01.3.1). These two plots also set the range for FVS, which varied from 0.12 (WM_01.4.4) to 2.20 (WM_01.3.1).

Figure 3.2-c shows the exotic dominance categories for West Macgregor. The majority of the exotic areas were classified as 'Noxious Weed Species', being dominated by Chilean Needle Grass. The remaining areas were classified as 'Pasture and Agricultural Weed Species'.

Significant weeds were found throughout the site, including Chilean Needle Grass (all zones), Serrated Tussock (all zones), Paspalum (all zones), Phalaris (Zone 4), African Lovegrass (Zone 4) and Tall Fescue (Zone 4). Other pest plants that were widespread include Paterson's Curse, Saffron Thistle and Briar Rose.

Many Golden Sun Moths were also observed within the site, primarily associated with Chilean Needle Grass dominated areas of the Ginninderra Creek floodplain. No other threatened or rare species were recorded.

Tables 3.5a-3.5b provide summaries of the plot results for Zone 3 and Zone 4. Detailed summaries of the floristics and step-point transects for each plot are provided in Appendix 1 and 2, respectively.

Table 3.5-a. West Macgregor ACT01 Zone 3 results summary

| | ACT01 Zone 3 |
|--------------------------------|--|
| Description | Native grassland. Native-dominated (Austrostipa/Rytidosperma association), with some forbs present. This zone has low diversity and does not meet the EPBC Act criteria for NTG-SEH. |
| Size | 24.19 ha (4 plots and 4 transects). |
| Native Species Richness | 4-7 total native species, 0-2 native non-grass species, 0 indicator species. |
| Exotic Species Richness | 10-16 species. |
| Significant Weeds | Chilean Needle Grass, Serrated Tussock and Paspalum, with a low combined cover (less than 5%). Paterson's Curse, Saffron Thistle, Briar Rose, Spear Thistle and St John's Wort also present. |
| WVS | Average of 12.52 (range of 11.76 to 13.99). |
| FVS | Average of 1.64 (range of 1.20 to 2.20). |



Table 3.5-b. West Macgregor ACT01 Zone 4 results summary

| | ACT01 Zone 4 |
|--------------------------------|---|
| Description | This zone is dominated by exotic vegetation. The low-lying areas close to Ginninderra Creek, which comprise most of the exotic areas of the site, are dominated by Chilean Needle Grass. The other areas support a mix of Paspalum, Phalaris, broadleaf weeds and exotic annuals. |
| Size | 11.77 ha (4 plots and 4 transects). |
| Native Species Richness | 1-6 total native species, 1-2 native non-grass species, 0 indicator species. |
| Exotic Species Richness | 9-16 species. |
| Significant Weeds | Chilean Needle Grass, Serrated Tussock, Paspalum, Phalaris, African Lovegrass and Tall Fescue, with a low to very high combined cover (less than 5% up to greater than 75%). Paterson's Curse, Saffron Thistle, Briar Rose, Blackberry and Spear Thistle also present. |
| WVS | Average of 13.52 (range of 10.12 to 16.43). |
| FVS | Average of 1.01 (range of 0.12 to 1.60). |



3.5.2 Discussion and comparison to previous mapping

Discussion and recommendations to improve grassland quality

The vegetation quality within West Macgregor is very similar to the more degraded areas of the adjoining Jarramlee site (refer Section 3.2). The eastern portion of the site associated with the Ginninderra Creek floodplain is characterised by a near monoculture of Chilean Needle Grass (ACT01 Zone 4), whilst the majority of the larger paddock located upslope supports native Tall Speargrass dominated grassland with low forb diversity (ACT01 Zone 3). One very small patch (0.07 ha) of moderately diverse Kangaroo Grass dominated grassland (ACT01 Zone 2) was identified, which has likely persisted in moderate quality as the rocks have decreased the grazing pressure and nitrification from stock.

As shown in Figure 3.2-c, the majority of the ACT01 Zone 4 areas (i.e. exotic dominated) are dominated by Chilean Needle Grassland and are therefore classified as 'Noxious Weed Species'. The drainage lines running through the native grassland paddock are not yet infested with Chilean Needle Grass and are instead dominated by 'Pasture and Agricultural Species' (notably *Phalaris* and Tall Fescue). The Chilean Needle Grass occurring throughout the Ginninderra Creek floodplain poses the greatest threat to the site's expanses of Tall Speargrass dominated low diversity native grassland (ACT01 Zone 3). Whilst not yet a dominant species in ACT01 Zone 3, Chilean Needle Grass does occur as individual plants or small patches throughout much of this zone. Chilean Needle Grass is not spread by wind, rather its key dispersal vectors are overland waterflows, stock (internally and externally), and potentially native and exotic fauna. Blackberry and Briar Rose also occur at high density throughout much of the site, and the many juvenile plants of each species observed during the current field surveys suggests that these species are spreading rapidly within the site.

Although the site does not support substantial patches of NTG-SEH, it is recommended that the spread of Chilean Needle Grass into areas above the Ginninderra Creek Floodplain is addressed as a key management priority. This will be best achieved via spot spraying of newly established plants, together with controlling stock movements during seed set from heavily infested areas into the cleaner areas upslope. The Chilean Needle Grass is so well entrenched throughout the floodplain that its eradication or substantial reduction is unlikely to be achievable, particularly given that any treated areas would simply be re-sown with the species during the next flood event. It is also noted that the Chilean Needle Grass dominated floodplain areas in West Macgregor, together with the adjoining Jarramlee site, now support one of the largest and most densely occupied remaining patches of Golden Sun Moth habitat (Biosis 2014; SMEC 2016; Umwelt 2017; observations during current surveys), a critically endangered species which is known to feed on Chilean Needle Grass as an alternative to its native feed species (primarily grasses in the genera *Rytidosperma* and *Austrostipa*).

With regard to the above, it is recommended that a conservation-targeted management plan be prepared which prescribes a management regime for the site. This management regime should stipulate the stocking rates, rotational grazing with restrictions to movement during late spring, and other focused measures that will be applied to protect and enhance the native grassland (PCT01 Zone 3) and Golden Sun Moth habitat values of the site. In this regard, it is recommended that the site is split into two broad management units, one focused on protecting native grassland from noxious weed spread and proliferation (grass and woody weeds), the other focused on retaining the Golden Sun Moth habitat whilst restricting the production of Chilean Needle Grass seed and its spread within the site and into the broader catchment.

Comparison to previous mapping

David Hogg Pty Ltd (2005²²) prepared an ecological assessment of West Macgregor to inform a concept plan prepared for the extension to the suburb of Macgregor. The study included assessment of the overall quality of the grassland remnants within the site in the context of the then draft ACT Government (2005), this involved preparation of a generalised map of the grassland characteristics categorising the vegetation as either 'Natural Temperate Grassland', 'Native Pasture', 'Degraded Native Pasture', or 'Introduced Pasture'. The study did not allocate a 'Botanical Significance Rating' (BSR) to the vegetation *"because of the very limited extent of natural temperate grassland"* within the site.

Whilst noting the adverse impacts that the planted trees have had on the grassland quality within the site, David Hogg Pty Ltd (2005) noted that the groundcover characteristics were recognisable in the planting areas and that the groundcover was generally consistent with the surrounding areas. This approach (i.e. ignoring planted woody vegetation in natural grassland PCTs) is consistent with that applied for the current study, as is the observation that the groundcover under planted trees is usually consistent with that of the surrounding areas (with the exception of stock camps associated with trees).

As shown in Figure 3.1 of David Hogg Pty Ltd (2005), the Ginninderra Creek floodplain areas were identified as 'Introduced Pasture', the large paddocks located above the floodplain were identified as 'Native Pasture', and the northern paddock was identified as 'Degraded Native Pasture'. Notwithstanding the differences in survey methods and mapping scale, comparison between this mapping prepared in 2005 is generally consistent with that of the current study (notably 'Native Pasture' roughly equates to ACT01 Zone 3 and 'Introduced Pasture' roughly equates to ACT01 Zone 4). It is also interesting that the single small patch of ACT01 Zone 2 was also identified in 2005 and labelled as 'Rocky knoll with Themeda' on the mapping.

Although the differences in scale and mapping methods prevent direct comparison between the mapping prepared by David Hogg Pty Ltd (2005) and the current study, it appears that the grassland quality and extent within the site has not substantially changed.

²² David Hogg Pty Ltd (2005). *West Macgregor Ecological Assessment*. Report prepared for Purdon Associates Pty Ltd on behalf of the ACT Planning and Land Authority. August 2005.

3.6 Woolshed Creek

3.6.1 Grassland mapping results

Figure 3.6-a shows the extent of the grassland PCT and zones for Woolshed Creek, the location of the floristic quality plots and step-point transects, and the associated Floristic Value Scores. The location of the NW corner of each plot and the start/end location of transects are provided in Appendix 1 and 2, respectively.

Woolshed Creek was found to support one PCT: 'ACT01 Tablelands Dry Tussock Grassland', with the following zones.

- 21.84 ha of Zone 3: Native dominant – Low diversity (not meeting the EPBC Act criteria for NTG-SEH).
- 37.97 ha Zone 4: Exotic dominated – Low diversity.

Woolshed Creek does not support any areas which meet the EPBC Act criteria for NTG-SEH.

Native species richness ranged from 1 native species (WC_01.4.2) to 7 native species (WC_01.3.3). These two plots also set the range for FVS, which varied from 0.30 (WC_01.4.2) to 1.95 (WC_01.3.3).

Figure 3.6-b shows the exotic dominance categories for Woolshed Creek. The majority of the exotic areas were classified as 'Noxious Weed Species', being dominated by Chilean Needle Grass. The remaining areas were classified as 'Pasture and Agricultural Weed Species', with two 'Stock Camps' present.

Significant weeds were found throughout the site, including Chilean Needle Grass (all zones), Serrated Tussock (all zones), Paspalum (all zones), Tall Fescue (all zones) and African Lovegrass (Zone 3). Other pest plants that were widespread include Saffron Thistle.

Many Golden Sun Moths were also observed during the surveys, occurring throughout much of the site. No other threatened or rare species were recorded.

Tables 3.6a-3.6b provide summaries of the plot results for each zone. Detailed summaries of the floristics and step-point transects for each plot are provided in Appendix 1 and 2, respectively.

Table 3.6-a. Woolshed Creek ACT01 Zone 3 results summary

| | ACT01 Zone 3 |
|--------------------------------|--|
| Description | Native grassland. Native-dominated (Austrostipa/Rytidosperma association), with some forbs present. This zone has low diversity and does not meet the EPBC Act criteria for NTG-SEH. |
| Size | 21.84 ha (4 plots and 4 transects). |
| Native Species Richness | 4-7 total native species, 1-2 native non-grass species, 0 indicator species. |
| Exotic Species Richness | 10-14 species. |
| Significant Weeds | Chilean Needle Grass, Serrated Tussock, Paspalum, Tall Fescue and African Lovegrass, with a low to moderate combined cover (less than 5% up to 25%). Saffron Thistle, Scotch Thistle, Spear Thistle and Paterson's Curse also present. |
| WVS | Average of 9.41 (range of 5.84 to 13.18). |
| FVS | Average of 1.37 (range of 1.02 to 1.95). |



Table 3.6-b. Woolshed Creek ACT01 Zone 4 results summary

| | ACT01 Zone 4 |
|-------------------------|---|
| Description | This zone is dominated by exotic vegetation. The low-lying areas close to Woolshed Creek, which comprise most of the exotic areas in the site, are dominated by Chilean Needle Grass. The other areas support a mix of Phalaris, Cocksfoot, broadleaf weeds and exotic annuals. |
| Size | 37.97 ha (4 plots and 4 transects). |
| Native Species Richness | 1-4 total native species, 0-4 native non-grass species, 0 indicator species. |
| Exotic Species Richness | 11-13 species. |
| Significant Weeds | Chilean Needle Grass, Serrated Tussock, Paspalum and Tall Fescue, with a moderate to very high combined cover (25% up to greater than 75%). Saffron Thistle and Starthistle also present. |
| WVS | Average of 15.19 (range of 10.29 to 17.62). |
| FVS | Average of 0.77 (range of 0.30 to 1.52). |



3.6.2 Discussion and comparison to previous mapping

Discussion and recommendations to improve grassland quality

Much of Woolshed Creek has undergone a history of prolonged and intensive pasture improvement via the sowing of Phalaris, Cocksfoot and various Clovers, and addition of superphosphate (R. Speirs 2013 discussions with lessees, Ron McKeahnie and Shane Keir). This pasture improvement, together with a history of stock (cattle, sheep, horses and Shetland ponies) grazing under a generally set-stocking arrangement, has undoubtedly encouraged the dominance of native and exotic tussock-forming grasses, and led to the loss of all but the most disturbance tolerant native forbs from the site. The areas of native dominance (PCT01 Zone 3) are generally associated with the higher elevated ridges, the drainage lines and the Woolshed Creek floodplain support exotic pasture (PCT01 Zone 4). The extensive areas of PCT01 Zone 4 shown as 'Noxious Weed Species' dominance in Figure 3.6-b, generally associated with the Woolshed Creek floodplain, are heavily infested with Chilean Needle Grass such that it has become the dominant grass species.

It is highly unlikely that the floristic diversity of the site would increase substantially under any change in land management. The Chilean Needle Grass is also so widespread and well entrenched that its eradication or substantial reduction is unlikely to be achievable.

Woolshed Creek supports one of the largest and most densely occupied remaining patches of Golden Sun Moth habitat (Biosis 2014a²³), a critically endangered species which is known to feed on Chilean Needle Grass as an alternative to its native feed species (primarily grasses in the genera *Rytidosperma* and *Austrostipa*). Indeed, the primary conservation value of the site is its value as Golden Sun Moth habitat. As such, given the current low floristic values of the site and the low likelihood of natural or assisted improvement in these values, it is recommended that management of the site focus primarily on maximising the habitat quality for the Golden Sun Moth and thus maximising the size and resilience of the population within the site. The site also supports a large, yet low density, population of the Striped Legless Lizard habitat (Biosis 2014b²⁴). It is recommended that site management also focuses on conservation of this vulnerable species, however this should occur only to the extent that it is compatible with managing the site for Golden Sun Moth conservation.

With regard to the above, it is recommended that a conservation-targeted management plan be prepared which prescribes a management regime for the site. This management regime should stipulate the stocking rates, rotational grazing, and other focused measures that will be applied to protect and enhance the threatened grassland fauna habitat values of the site.

Comparison to previous mapping

The structure and floristic composition of the vegetation within Woolshed Creek was broadly assessed and mapped by Biosis (2013²⁵), the primary purpose of which was to determine the ecological values of the site and corresponding constraints to the proposed development of the site and adjoining land. The Biosis study involved classification and mapping of the vegetation within the site applying the 'methodology for classifying lowland grasslands' provided by ACT Government

²³ Biosis (2014a). *Majura Golden Sun Moth Targeted Survey Report*. Report for ACT Land Development Agency. Authors: S. Vertucci & R. Speirs. Biosis Pty Ltd, Canberra. Project no 17040.

²⁴ Biosis (2014b). *Majura Striped Legless Lizard Survey Report*. Report for ACT Land Development Agency. Authors: S. Vertucci & R. Speirs. Biosis Pty Ltd, Canberra. Project no 17017.

²⁵ Biosis (2013). *Majura-Pialligo Ecological Constraints Assessment*. Report for the ACT Land Development Agency. Authors: S. Vertucci & R. Speirs, Biosis Pty Ltd, Canberra. Project number 16511.

(2010²⁶). Vegetation polygon boundaries were delineated in the field and this data was used to develop fine scale GIS-prepared vegetation mapping. A series of plots and step-point transects were completed to record the floristic composition and structure of the three defined vegetation units: 'Native Pasture'; 'Borderline Native/Exotic Pasture'; and 'Exotic Pasture'. The areas identified as 'Borderline Native/Exotic Pasture' could not be confidently allocated to either of the other vegetation units during the May survey and given the very high grazing intensity of the subject paddocks.

The purpose of the Biosis study differed to that of this study, and the differences in scale and accuracy of the mapped polygons is a direct reflection of this. Notwithstanding this, Biosis' categorisation of the vegetation quality within the site is quite similar to that of this study (i.e. 'Native Pasture' ~ ACT01 Zone 3; 'Exotic Pasture – Tussock Formation Present' ~ ACT01 Zone 4). As detailed in Figure 3.6-a, the areas mapped as 'Borderline Native/Exotic Pasture' were able to be confidently categorised as either ACT01 Zone 3 or ACT01 Zone 4 during the December surveys for this study.

²⁶ ACT Government (2010). *Survey guidelines for determining lowland vegetation classification and condition in the ACT*. Environment and Sustainable Development Directorate – Conservation Planning and Research.

Figure 3.6-a. Woolshed Creek Vegetation Mapping Results



Figure 3.6-a. Woolshed Creek Vegetation Mapping Results

Capital Ecology Project No: 2759
 Drawn by: S. Reid
 Date: 25 March 2018

Figure 3.6-b. Woolshed Creek Exotic Vegetation Classification



Figure 3.6-b. Woolshed Creek Exotic Vegetation Classification

Capital Ecology Project No: 2759
 Drawn by: S. Reid
 Date: 29 March 2018

3.7 Yass Valley Lot 2

3.7.1 Grassland mapping results

Figure 3.7-a shows the extent of the grassland PCT and zones for Yass Valley Lot 2, the location of the floristic quality plots and step-point transects, and the associated Floristic Value Scores. The location of the NW corner of each plot and the start/end location of transects are provided in Appendix 1 and 2, respectively.

Yass Valley Lot 2 was found to support one PCT: 'ACT01 Tablelands Dry Tussock Grassland', with the following zones.

- 3.51 ha of Zone 1: Native dominant – High to very high diversity (meeting the EPBC Act criteria for NTG-SEH in 'high to very high condition').
- 34.27 ha of Zone 3: Native dominant – Low diversity (not meeting the EPBC Act criteria for NTG-SEH).
- 48.92 ha Zone 4: Exotic dominated – Low diversity.

In total, 3.51 ha of grassland in Yass Valley Lot 2 meets the EPBC Act criteria for NTG-SEH (Figure 3.7-b).

Native species richness ranged from 0 native species (YV_01.4.1 and YV_01.4.2) to 20 native species (YV_01.1.1). The FVS varied from 0 (YV_01.4.1 and YV_01.4.2) to 23.49 (YV_01.1.3).

Figure 3.7-c shows the exotic dominance categories for Yass Valley Lot 2. The entirety of the exotic areas were classified as 'Pasture and Agricultural Weed Species'.

Significant weeds were found throughout the site, including *Paspalum* (all zones), *Phalaris* (all zones), Chilean Needle Grass (Zone 1), Tall Fescue (Zone 1) and Serrated Tussock (Zone 3). Other pest plants that were widespread include Saffron Thistle, Paterson's Curse and Spear Thistle.

One uncommon species, Pale Flax Lily *Dianella longifolia* var. *longifolia*, was recorded in plot YV_01.1.1 (Zone 1)²⁷. Many Golden Sun Moths were also observed within the site, primarily associated with the Zone 1 patches, and one Perunga Grasshopper *Perunga ochracea* was recorded nearby patches of Zone 1 in the north of the site²⁸.

Tables 3.7a-3.7c provide summaries of the plot results for each zone. Detailed summaries of the floristics and step-point transects for each plot are provided in Appendix 1 and 2, respectively.

²⁷ Species location data removed

²⁸ <https://canberra.naturemapr.org/Community/Sighting/3387633>

Table 3.7-a. Yass Valley Lot 2 ACT01 Zone 1 results summary

| | ACT01 Zone 1 |
|--------------------------------|--|
| Description | NTG-SEH. Native-dominated (Themeda/Austrostipa/Rytidosperma association), supporting a high to very high diversity of native grass and forb species. One uncommon species, Pale Flax Lily <i>Dianella longifolia</i> var. <i>longifolia</i> , was recorded in (<i>species location data removed</i>). |
| Size | 3.51 ha (4 plots and 4 transects). |
| Native Species Richness | 14-20 total native species, 7-9 native non-grass species, 4-8 indicator species. |
| Exotic Species Richness | 8-14 species. |
| Significant Weeds | Paspalum, Chilean Needle Grass, Phalaris and Tall Fescue, with a low combined cover (less than 5%). St John's Wort, Paterson's Curse, Saffron Thistle, Briar Rose and Spear Thistle also present. |
| WVS | Average of 6.60 (range of 3.30 to 11.40). |
| FVS | Average of 18.79 (range of 13.10 to 23.49). |

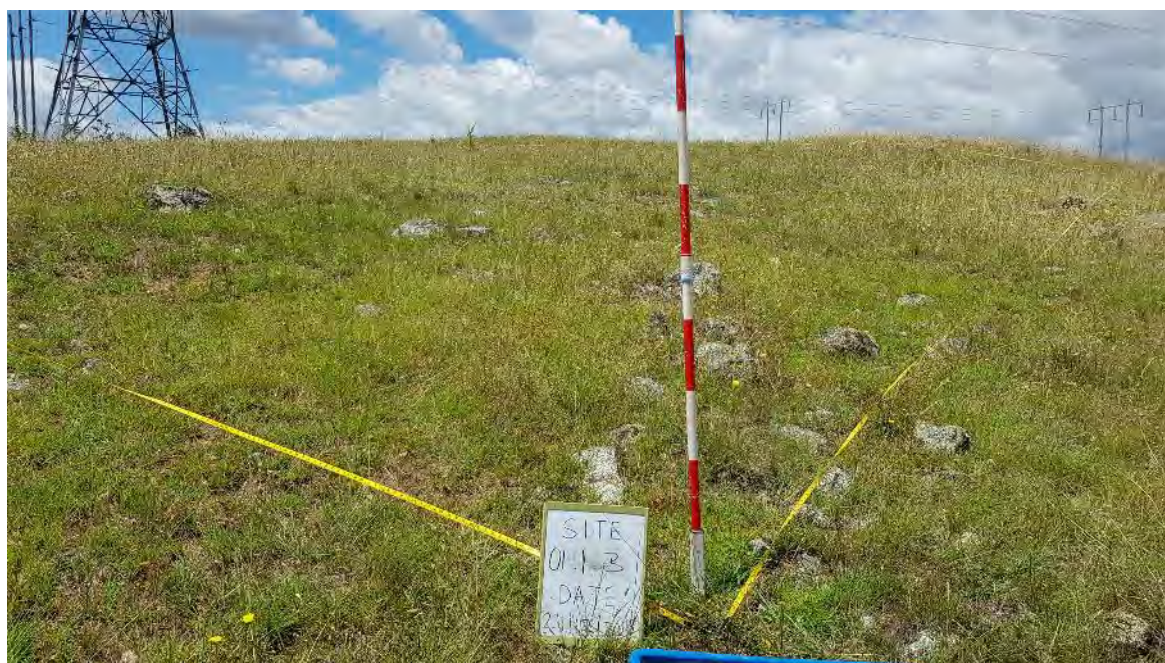


Table 3.7-b. Yass Valley Lot 2 ACT01 Zone 3 results summary

| | ACT01 Zone 3 |
|--------------------------------|---|
| Description | Native grassland. Native-dominated (Austrostipa/Microlaena association), with some forbs present. This zone has lower diversity than Zone 1 and Zone 2 and does not meet the EPBC Act criteria for NTG-SEH. |
| Size | 34.27 ha (4 plots and 4 transects). |
| Native Species Richness | 6-9 total native species, 1-2 native non-grass species, 0 indicator species. |
| Exotic Species Richness | 8-9 species. |
| Significant Weeds | Chilean Needle Grass, Phalaris and Paspalum, with a low combined cover (less than 5%). Saffron Thistle, Paterson's Curse, Spear Thistle and Aaron's Rod also present. |
| WVS | Average of 5.68 (range of 4.03 to 8.70). |
| FVS | Average of 1.87 (range of 1.40 to 2.25). |



Table 3.7-c. Yass Valley Lot 2 ACT01 Zone 4 results summary

| | ACT01 Zone 4 |
|--------------------------------|---|
| Description | This zone is dominated by exotic vegetation, namely Phalaris, Yorkshire Fog <i>Holcus lanatus</i> , broadleaf weeds and exotic annuals. |
| Size | 48.92 ha (4 plots and 4 transects). |
| Native Species Richness | 0-5 total native species, 0-1 native non-grass species, 0 indicator species. |
| Exotic Species Richness | 5-9 species. |
| Significant Weeds | Phalaris and Paspalum, with a moderate to very high combined cover (25% up to greater than 75%). |
| WVS | Average of 7.84 (range of 6.59 to 9.59). |
| FVS | Average of 0.43 (range of 0 to 1.10). |



3.7.2 Discussion and comparison to previous mapping

Discussion and recommendations to improve grassland quality

Apart from the patches of NTG-SEH (ACT01 Zone 1), the vegetation quality within Yass Valley Lot 2 is relatively consistent and is comprised of either large expanses of *Austrostipa*/*Microlaena* native pasture containing some native forbs, or large expanses of *Phalaris*/Yorkshire Fog exotic pasture almost devoid of native forbs. The floristically diverse areas of NTG-SEH (3.51 ha) are dominated by Spear Grass, Wallaby Grass or Kangaroo Grass, and are generally found on the sloped sections of the site which border Gooromon Ponds creek.

Much of Yass Valley Lot 2 has likely undergone a history of prolonged and intensive pasture improvement via the sowing of *Phalaris* and addition of superphosphate. This pasture improvement, together with a history of low-intensity cattle grazing, has undoubtedly encouraged the dominance of native and exotic tussock-forming grasses, and led to the loss of many of the native forbs from large portions of the site. Interestingly, Chilean Needle Grass is absent throughout most of the site. This is true even along the creek, which is in stark contrast to the situation at the nearby Jarramlee and West Macgregor sites. This is most likely due to the fact that the Gooromon Ponds creek and Halls Creek catchment areas (including Hall, Kinlyside, CSIRO Experiment Station and NSW rural properties) are cleaner and support far less Chilean Needle Grass in comparison to that of the Ginninderra Creek catchment.

As shown in Figure 3.7-c, Yass Valley Lot 2 contains substantial areas of 'Pasture and Agricultural Species' (notably *Phalaris*, Yorkshire Fog and *Paspalum*) and substantial areas of low-diversity native pasture. It is unlikely that the floristic diversity of these areas of the site would increase substantially under any change in land management. Management should therefore focus on protecting the areas of NTG-SEH, encouraging their expansion where possible.

It is recommended that a conservation-targeted management plan be prepared which prescribes a management regime for the site. This management regime should stipulate the stocking rates, rotational grazing, targeted weed control works, and other focused measures that will be applied to protect and enhance the grassland conservation values of the site.

Comparison to previous mapping

The grassland within Yass Valley Lot 2 was assessed and mapped by Kellogg Brown & Root (2014²⁹). However, the methodology applied in their study differs substantially from the methodology used in the current study (or any other recent study in the ACT) and does not appear to rely on any currently approved grassland assessment method. Instead, areas of NTG were identified based on a comparison of the general characteristics of a patch to a reference description of the community and did not employ more quantitative methods or defined thresholds. As such, it is not possible to make any useful comparisons between the current and previous mapping. That said, the two patches of NTG identified by Kellogg Brown and Root (2014) are in the same locations as two of the patches identified in the current study, albeit mapped at a far broader scale. The current study also identified a number of patches of NTG-SEH in the south-west and east of the site.

²⁹ Kellogg Brown & Root Pty Ltd (2014). *Lots 1 & 2 Wallaroo Road, Vegetation Condition Assessment Report*. Report prepared for Department of Finance. February 2014.

Figure 3.7-a. Yass Valley Lot 2 Vegetation Mapping Results

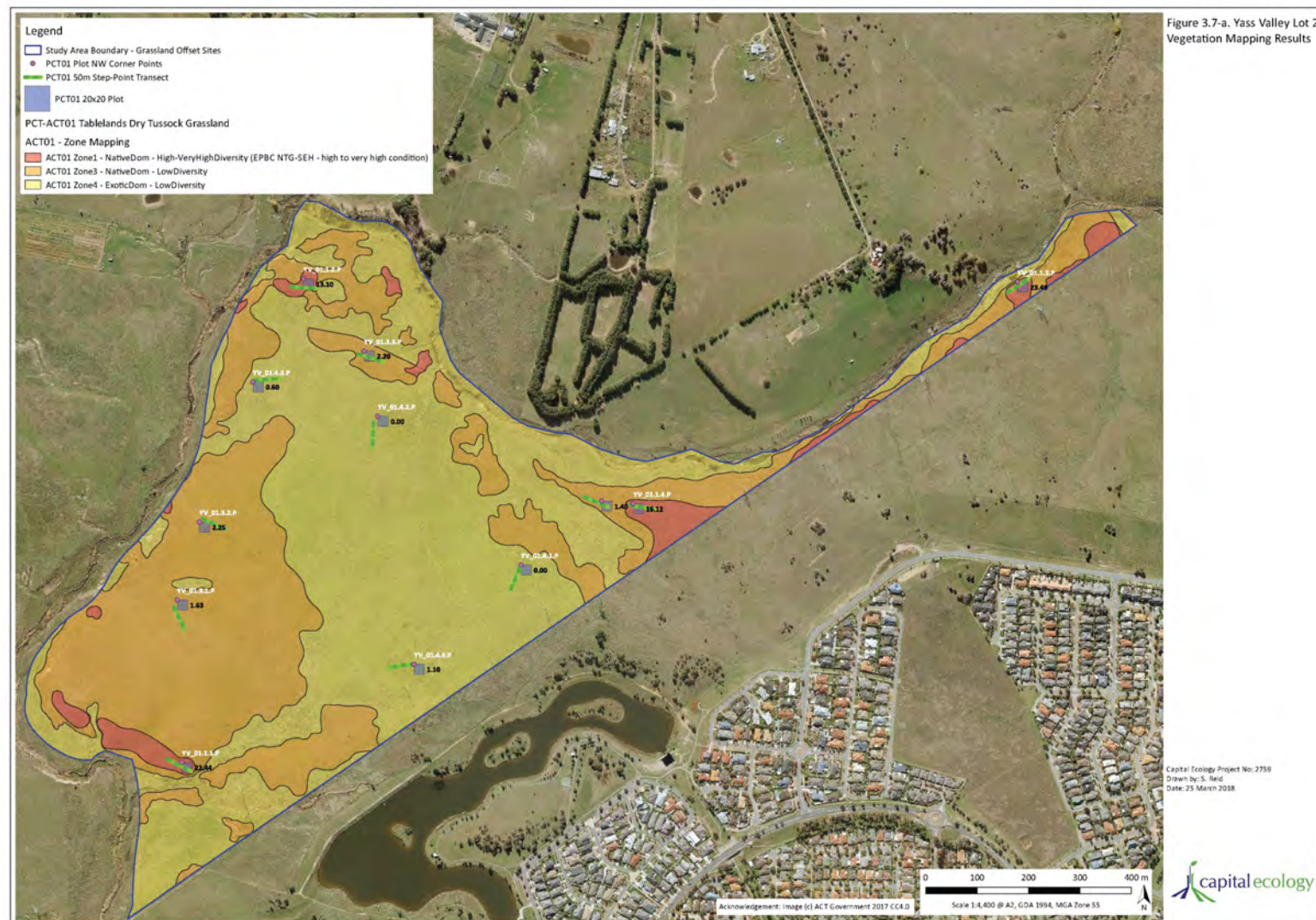


Figure 3.7-b. Yass Valley Lot 2 EPBC Act NTG-SHE

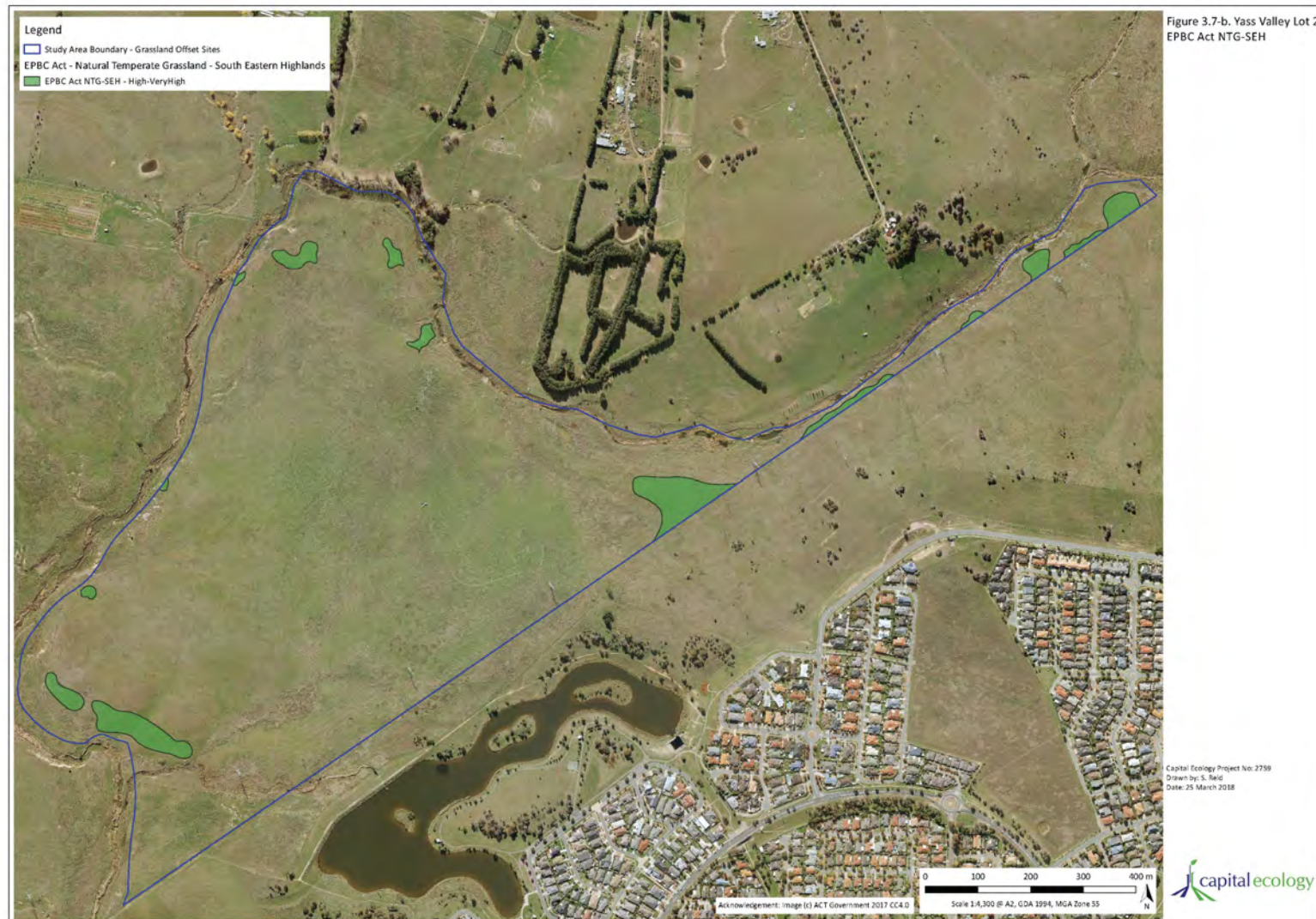
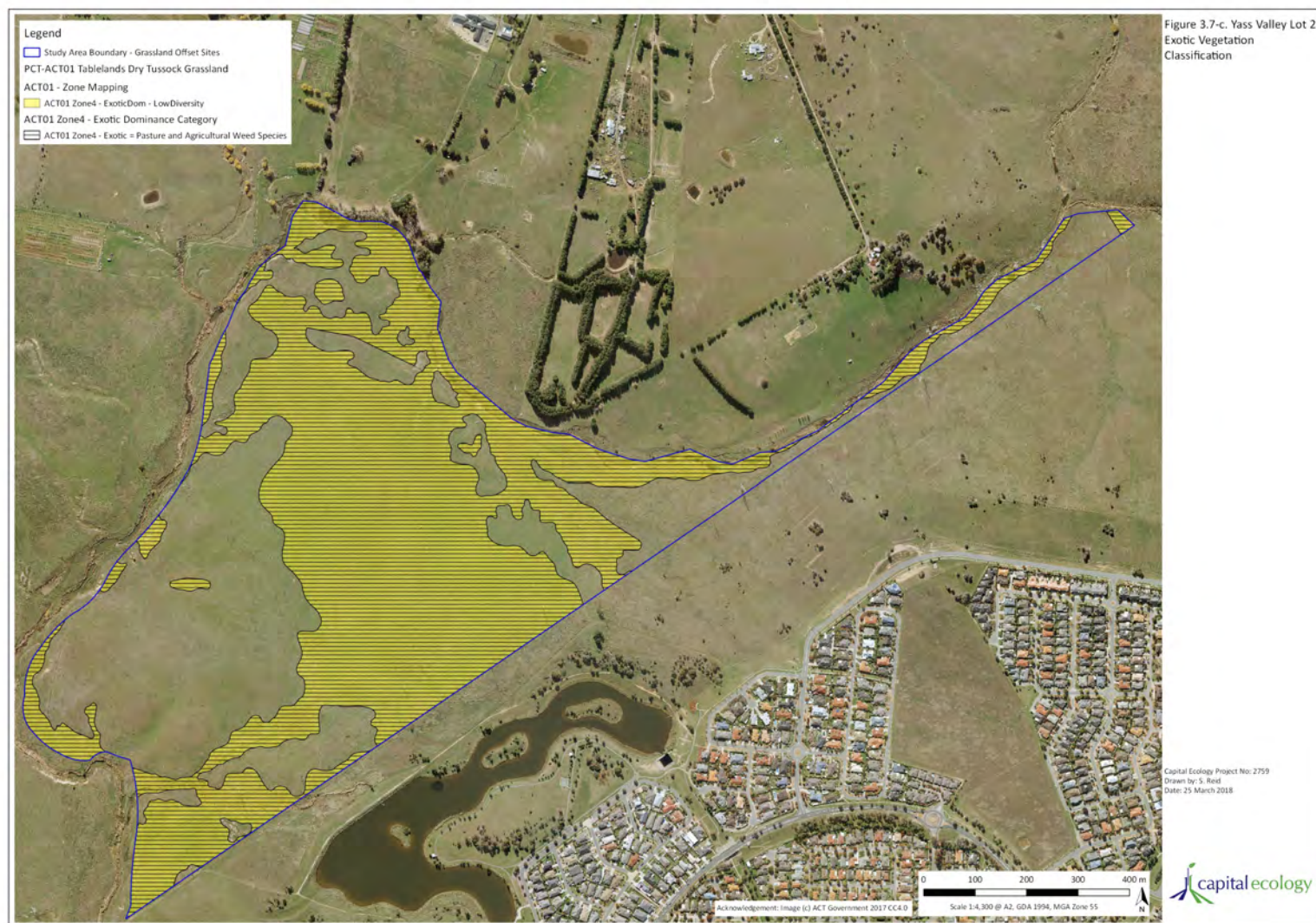


Figure 3.7-c. Yass Valley Lot 2 Exotic Vegetation Classification



Summary and Conclusion

Capital Ecology was commissioned by PCS to assess and map the quality and extent of the grassland within seven ACT locations ('sites'). Each site is known to support grassland which meets the definition for the NTG-SEH threatened ecological community, and/or habitat for significant grassland fauna species such as the Golden Sun Moth and Striped Legless Lizard. The results presented in this report provide fine-scale mapping of the seven sites and establish an accurate and reliable baseline assessment from which ongoing management and monitoring of the significant biodiversity values can be achieved. This report also establishes a reliable and repeatable four-step methodology which can be used to determine future changes in grassland quality and extent, and which will further aid management decisions by differentiating areas of exotic dominance based on the category of exotic species that this dominance is attributed to.

The field surveys and mapping were timed to occur when the greatest number of grassland forbs were in full flower. This was determined from observations of known reference sites throughout the season. The weather conditions in 2017 (a dry start to winter with cold nights³⁰ and average spring rainfall with warm days³¹) resulted in average conditions during the survey period (i.e. normal conditions). The only effect of the weather we noted was a low annual grass cover due to the later than usual spring rains. In general, weather conditions are unlikely to have substantially influenced the results.

The quality and extent of grassland in each of the sites has been mapped previously, and comparisons to the results of those studies are discussed in the subsection for each site. In general, the mapping prepared via this study is broadly consistent with that prepared previously. However, the four-step mapping method employed for this study, applied with a focus on accuracy rather than time constraints, has resulted in the development of a mapping product which is far more detailed and fine-scale than that prepared previously. In this regard, it is difficult to make direct comparisons with previous mapping and thereby form conclusions regarding changes in grassland quality and extent. Such comparisons will be possible in the future providing that the four-step mapping method is employed, and survey/mapping effort are sufficient to produce appropriately accurate mapping.

Table 4-a summarises the areas of NTG-SEH (Zones 1 and 2), Native Grassland (Zone 3) and Exotic Pasture (Zone 4) for each site. Of the seven sites, Majura West Grassland supports the greatest total area of NTG-SEH (18.29 ha), followed by Jarramlee (6.80 ha), Yass Valley Lot 2 (3.51 ha) and Bonshaw (2.46 ha). Kenny Grassland and Woolshed Creek do not contain any NTG-SEH and, whilst one very small (0.07 ha) patch of Zone 2 was mapped in West Macgregor, this patch is smaller than the minimum patch size stipulated for NTG-SEH. Although being of low botanical conservation value, Kenny Grassland, Woolshed Creek and West Macgregor each support habitat of very high value for threatened grassland fauna species. Management recommendations are provided in the subsection for each site, however common recommendations across the sites include management of grazing intensity and timing via varied stocking rates and rotational grazing, and management of noxious and/or prolific weeds.

³⁰ Commonwealth of Australia (2017). *Australian Capital Territory in winter 2017: dry season with warm days and cool nights*. Bureau of Meteorology Seasonal Climate Summary for Canberra.

³¹ Commonwealth of Australia (2017). *Australian Capital Territory in spring 2017: warmer than average days*. Bureau of Meteorology Seasonal Climate Summary for Canberra.

Table 4-a. Summary of the areas of NTG-SEH, Native Grassland and Exotic Pasture

| Site | NTG-SEH (ha) Zones 1 and 2 | Native Grassland (ha) Zone 3 | Exotic Pasture (ha) Zone 4 |
|-----------------------|-------------------------------|---------------------------------|-------------------------------|
| Bonshaw | 2.46 | 164.95 | 41.81 |
| Jarramlee | 6.80 | 48.10 | 45.79 |
| Kenny Grassland | 0 | 15.48 | 41.12 |
| Majura West Grassland | 18.29 | 41.97 | 35.19 |
| West Macgregor | 0.07 | 24.19 | 11.77 |
| Woolshed Creek | 0 | 21.84 | 37.97 |
| Yass Valley Lot 2 | 3.51 | 34.27 | 48.92 |

Table 4-b summarises the native characteristics of the four vegetation zones for each site. With regard to benchmark scores for native diversity, provided by PCS –

ACT01 Tablelands Dry Tussock Grassland (Austrostipa/Rytidosperma association): The benchmark native species richness for this community is 30 species.

We note that none of the plots reached this value, with a maximum of 20 species for Bonshaw, Majura West Grassland and Yass Valley Lot 2, and 19 species for Jarramlee. In most cases the vales for native grass cover and native ‘other’ cover are also often below the benchmark values. To improve the current site values to benchmarks, we recommend that management focus on preserving those areas currently of the highest quality and improving areas which have the potential to substantially improve (e.g. those with a high FVS, or those with higher than expected FVS for their current vegetation zone classification).

Significant weeds such as African Lovegrass, Serrated Tussock and Chilean Needle Grass are present within all of the sites. Chilean Needle Grass is particularly prolific within sections of Majura West Grassland, Jarramlee, West Macgregor and Woolshed Creek, and Serrated Tussock now occurs at very high densities within sections of Majura West Grassland and Kenny Grassland. In general, these weeds represent the foremost threat to the integrity of the botanical and fauna habitat values of the grasslands. Accordingly, diligent and systematic control of these weeds (together with Blackberry and Briar Rose on several sites) is required to conserve and enhance the values of the sites. Notwithstanding this, it is also important that weed control carefully balances the at times contradictory management requirements of the values of the site (i.e. where Chilean Needle Grass is important habitat for the Golden Sun Moth). Also of concern are other pest plants, such as St John’s Wort, Paterson’s Curse and Saffron Thistle, which are often widespread and at high densities. These prolific weeds are likely to be having a detrimental impact on the grasslands in addition to that of the identified significant weeds. These weeds are often very difficult to effectively control, particularly as the targeted control method for one species may exacerbate the spread and density of other herbaceous weeds and/or the three significant grass weeds. Methods such as controlled grazing should be considered in low-diversity areas, and ecological burns in high-diversity areas.

Finally, with respect to the four-step mapping method employed for this study, it is suggested that the method used to calculate FVS, in particular the Significance Rating given to some species, warrants revision in order to be more specific to the grasslands in the ACT. Currently, the Significance Ratings for species in the ACT are based on the NSW region ‘South Eastern Highlands excluding the Monaro’ (Rehwinkle 2015). As a result, some species have a Significance Rating which appears to be inappropriately high. For example, *Lomandra filiformis* subsp. *coriacea*, *Poa*

sieberiana, and *Cheilanthes sieberi* have a Significance Rating of 'A', this rating is too high as they are not usually indicators of high quality grasslands in the ACT. Similar examples exist for Significance Rating 'B' species, such as *Vittadinia* spp. and *Wahlenbergia* spp. By reducing the Significance Rating of such species, the accumulated FVS would better reflect the quality of grasslands in the ACT.

Table 4-b. Summary of average Native Species Richness (NSR), average number of Indicator Species (IS) and average Floristic Value Score (FVS) – per vegetation zone and site

| Site | Zone 1 | Zone 1 | Zone 1 | Zone 2 | Zone 2 | Zone 2 | Zone 3 | Zone 3 | Zone 3 | Zone 4 | Zone 4 | Zone 4 |
|-----------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| | NSR | IS | FVS | NSR | IS | FVS | NSR | IS | FVS | NSR | IS | FVS |
| Bonshaw | 17.0 | 6.7 | 20.1 | 9.0 | 3.0 | 9.1 | 6.4 | 0.3 | 2.3 | 3.5 | 0 | 0.9 |
| Jarramlee | 15.3 | 6.8 | 20.3 | 7.2 | 2 | 7.1 | 7.6 | 1.8 | 4.5 | 4.4 | 0.6 | 1.7 |
| Kenny Grassland | - | - | - | - | - | - | 5.0 | 0.3 | 1.6 | 3.75 | 0 | 0.99 |
| Majura West Grassland | 17.3 | 6.5 | 24.5 | 13.0 | 2.5 | 8.8 | 7.8 | 1.0 | 3.2 | 4.3 | 0.3 | 2.1 |
| West Macgregor | - | - | - | - | - | - | 5.5 | 0 | 1.6 | 4.0 | 0 | 1.0 |
| Woolshed Creek | - | - | - | - | - | - | 5.0 | 0 | 1.4 | 2.8 | 0 | 0.8 |
| Yass Valley Lot 2 | 17.3 | 6.0 | 18.8 | - | - | - | 7.3 | 0 | 1.9 | 1.8 | 0 | 0.4 |

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Appendices

Appendix 1. Floristic Plot Data Summary Tables

Table A1-0-a. Bonshaw plot data summary

| Site | PCT | Zone | Plot ID | Easting | Northing | Native spp | Indicator spp | Native non-grass spp | Threatened spp | Exotic spp | Significant weeds | Sig weed cover % (level 'X' weeds only) | Significant weed spp. (level 'X' weeds in bold) | Floristic Value Score | Weed Value Score | Zone FVS Average |
|---------|-------|------|-----------|---------|----------|------------|---------------|----------------------|----------------|------------|-------------------|---|--|-----------------------|------------------|------------------|
| Bonshaw | ACT01 | 1 | Bo_01.1.1 | 698928 | 6085829 | 20 | 6 | 14 | 0 | 9 | 1 | < 5 | <i>Eragrostis curvula</i> <i>Carthamus lanatus</i> | 18.09 | 7.94 | 20.14 |
| Bonshaw | ACT01 | 1 | Bo_01.1.2 | 699007 | 6085786 | 17 | 7 | 9 | 0 | 8 | 1 | < 5 | <i>Nassella trichotoma</i> | 20.61 | 4.83 | 20.14 |
| Bonshaw | ACT01 | 1 | Bo_01.1.3 | 699590 | 6085639 | 14 | 7 | 9 | 0 | 11 | 2 | < 5 | <i>Eragrostis curvula</i> <i>Nassella trichotoma</i> <i>Carthamus lanatus</i> | 21.71 | 9.38 | 20.14 |
| Bonshaw | ACT01 | 2 | Bo_01.2.1 | 699387 | 6085431 | 9 | 2 | 7 | 0 | 16 | 3 | < 5 | <i>Eragrostis curvula</i> <i>Nassella neesiana</i> <i>Nassella trichotoma</i> <i>Carthamus lanatus</i> | 7.58 | 11.74 | 9.05 |
| Bonshaw | ACT01 | 2 | Bo_01.2.2 | 697436 | 6084055 | 9 | 4 | 6 | 0 | 9 | 2 | < 5 | <i>Nassella trichotoma</i> <i>Phalaris aquatica</i> <i>Carthamus lanatus</i> <i>Hypericum perforatum</i> | 10.52 | 7.62 | 9.05 |
| Bonshaw | ACT01 | 3 | Bo_01.3.1 | 698467 | 6085989 | 10 | 0 | 4 | 0 | 11 | 1 | < 5 | <i>Eragrostis curvula</i> <i>Carthamus lanatus</i> <i>Verbascum thapsus</i> | 3.30 | 5.58 | 2.25 |
| Bonshaw | ACT01 | 3 | Bo_01.3.2 | 698510 | 6085662 | 5 | 0 | 1 | 0 | 8 | 1 | < 5 | <i>Nassella trichotoma</i> <i>Carthamus lanatus</i> <i>Cirsium vulgare</i> | 2.20 | 4.74 | 2.25 |
| Bonshaw | ACT01 | 3 | Bo_01.3.3 | 699028 | 6085481 | 10 | 2 | 3 | 0 | 4 | 0 | 0 | <i>Verbascum thapsus</i> | 4.66 | 2.52 | 2.25 |
| Bonshaw | ACT01 | 3 | Bo_01.3.4 | 698525 | 6084943 | 4 | 0 | 1 | 0 | 9 | 1 | < 5 | <i>Phalaris aquatica</i> <i>Carthamus lanatus</i> | 1.00 | 5.35 | 2.25 |
| Bonshaw | ACT01 | 3 | Bo_01.3.5 | 698227 | 6084765 | 5 | 0 | 1 | 0 | 6 | 1 | < 5 | <i>Phalaris aquatica</i> <i>Carthamus lanatus</i> | 1.53 | 5.66 | 2.25 |
| Bonshaw | ACT01 | 3 | Bo_01.3.6 | 697777 | 6084608 | 4 | 1 | 2 | 0 | 14 | 3 | < 5 | <i>Nassella trichotoma</i> <i>Paspalum dilatatum</i> <i>Phalaris aquatica</i> <i>Carthamus lanatus</i> <i>Onopodum acanthium</i> | 2.01 | 13.07 | 2.25 |
| Bonshaw | ACT01 | 3 | Bo_01.3.7 | 698317 | 6084327 | 7 | 0 | 2 | 0 | 10 | 1 | < 5 | <i>Eragrostis curvula</i> <i>Carthamus lanatus</i> <i>Hypericum perforatum</i> <i>Onopodum acanthium</i> | 1.75 | 6.14 | 2.25 |

| Site | PCT | Zone | Plot ID | Easting | Northing | Native spp | Indicator spp | Native non-grass spp | Threatened spp | Exotic spp | Significant weeds | Sig weed cover % (level 'X' weeds only) | Significant weed spp. (level 'X' weeds in bold) | Floristic Value Score | Weed Value Score | Zone FVS Average |
|---------|-------|------|------------|---------|----------|------------|---------------|----------------------|----------------|------------|-------------------|---|---|-----------------------|------------------|------------------|
| Bonshaw | ACT01 | 3 | Bo_01.3.8 | 696993 | 6084389 | 6 | 0 | 1 | 0 | 10 | 2 | 5 - 25 | Eragrostis curvula Paspalum dilatatum <i>Hypericum perforatum</i> | 1.80 | 10.26 | 2.25 |
| Bonshaw | ACT01 | 3 | Bo_01.3.9 | 697375 | 6084336 | 4 | 0 | 1 | 0 | 13 | 1 | < 5 | Paspalum dilatatum <i>Carthamus lanatus</i> <i>Hypericum perforatum</i> <i>Verbascum thapsus</i> | 1.02 | 7.87 | 2.25 |
| Bonshaw | ACT01 | 3 | Bo_01.3.10 | 697984 | 6083861 | 9 | 0 | 3 | 0 | 8 | 1 | 5 - 25 | Eragrostis curvula <i>Carthamus lanatus</i> <i>Echium plantagineum</i> | 3.23 | 4.53 | 2.25 |
| Bonshaw | ACT01 | 4 | Bo_01.4.1 | 699229 | 6085389 | 3 | 0 | 1 | 0 | 12 | 2 | 50 - 75 | Paspalum dilatatum Phalaris aquatica <i>Cirsium vulgare</i> <i>Hypericum perforatum</i> | 0.70 | 12.59 | 0.87 |
| Bonshaw | ACT01 | 4 | Bo_01.4.2 | 698818 | 6085271 | 0 | 0 | 0 | 0 | 7 | 0 | 0 | <i>Onopodum acanthium</i> | 0.00 | 4.30 | 0.87 |
| Bonshaw | ACT01 | 4 | Bo_01.4.3 | 698228 | 6084184 | 6 | 0 | 2 | 0 | 4 | 1 | 25 - 50 | Phalaris aquatica | 1.62 | 5.63 | 0.87 |
| Bonshaw | ACT01 | 4 | Bo_01.4.4 | 697802 | 6083998 | 5 | 0 | 3 | 0 | 22 | 4 | < 5 | Eragrostis curvula Festuca arundinacea Paspalum dilatatum Phalaris aquatica <i>Carthamus lanatus</i> <i>Onopodum acanthium</i> <i>Rosa rubiginosa</i> | 1.15 | 15.51 | 0.87 |

Table A1-0-b. Jarramlee plot data summary

| Site | PCT | Zone | Plot ID | Easting | Northing | Native spp | Indicator spp | Native non-grass spp | Threatened spp | Exotic spp | Significant weeds | Sig weed cover % (level 'X' weeds only) | Significant weed spp. (level 'X' weeds in bold) | Floristic Value Score | Weed Value Score | Zone FVS Average |
|-----------|-------|------|-----------|---------|----------|------------|---------------|----------------------|----------------|------------|-------------------|---|---|-----------------------|------------------|------------------|
| Jarramlee | ACT01 | 1 | Ja_01.1.1 | 681589 | 6102712 | 19 | 8 | 11 | 0 | 12 | 0 | 0 | <i>Carthamus lanatus</i> <i>Hypericum perforatum</i> <i>Rosa rubiginosa</i> <i>Verbascum thapsus</i> | 24.32 | 6.03 | 26.26 |
| Jarramlee | ACT01 | 1 | Ja_01.1.2 | 681730 | 6102563 | 12 | 7 | 4 | 0 | 16 | 2 | < 5 | <i>Nassella neesiana</i> <i>Paspalum dilatatum</i> <i>Carthamus lanatus</i> <i>Hypericum perforatum</i> <i>Rosa rubiginosa</i> <i>Rubus fruticosus</i> | 18.59 | 12.03 | 26.26 |
| Jarramlee | ACT01 | 1 | Ja_01.1.3 | 681865 | 6102764 | 14 | 4 | 5 | 0 | 10 | 0 | < 5 | <i>Carthamus lanatus</i> <i>Echium plantagineum</i> <i>Verbascum virgatum</i> | 16.69 | 5.12 | 26.26 |
| Jarramlee | ACT01 | 1 | Ja_01.1.4 | 681764 | 6102664 | 16 | 8 | 5 | 0 | 14 | 1 | < 5 | <i>Festuca arundinacea</i> <i>Carthamus lanatus</i> <i>Rubus fruticosus</i> | 21.44 | 8.83 | 26.26 |
| Jarramlee | ACT01 | 2 | Ja_01.2.1 | 681432 | 6102912 | 11 | 3 | 4 | 0 | 7 | 0 | 0 | <i>Hypericum perforatum</i> | 9.62 | 3.00 | 6.71 |
| Jarramlee | ACT01 | 2 | Ja_01.2.2 | 682490 | 6103585 | 4 | 1 | 0 | 0 | 10 | 1 | < 5 | <i>Paspalum dilatatum</i> | 5.23 | 5.25 | 6.71 |
| Jarramlee | ACT01 | 2 | Ja_01.2.3 | 682506 | 6103511 | 8 | 2 | 3 | 0 | 13 | 2 | 5 - 25 | <i>Paspalum dilatatum</i> <i>Phalaris aquatica</i> <i>Echium plantagineum</i> <i>Hypericum perforatum</i> | 8.10 | 12.68 | 6.71 |
| Jarramlee | ACT01 | 2 | Ja_01.2.4 | 682384 | 6103584 | 3 | 1 | 0 | 0 | 12 | 1 | < 5 | <i>Paspalum dilatatum</i> <i>Echium plantagineum</i> <i>Hypericum perforatum</i> <i>Rosa rubiginosa</i> <i>Rubus fruticosus</i> | 4.75 | 7.60 | 6.71 |
| Jarramlee | ACT01 | 2 | Ja_01.2.5 | 682075 | 6102996 | 10 | 3 | 2 | 0 | 14 | 2 | < 5 | <i>Festuca arundinacea</i> <i>Paspalum dilatatum</i> <i>Carthamus lanatus</i> <i>Rubus fruticosus</i> | 7.83 | 11.09 | 6.71 |

| Site | PCT | Zone | Plot ID | Easting | Northing | Native spp | Indicator spp | Native non-grass spp | Threatened spp | Exotic spp | Significant weeds | Sig weed cover % (level 'X' weeds only) | Significant weed spp. (level 'X' weeds in bold) | Floristic Value Score | Weed Value Score | Zone FVS Average |
|-----------|-------|------|-----------|---------|----------|------------|---------------|----------------------|----------------|------------|-------------------|---|---|-----------------------|------------------|------------------|
| Jarramlee | ACT01 | 3 | Ja_01.3.1 | 681482 | 6102803 | 9 | 1 | 2 | 0 | 17 | 4 | < 5 | Eragrostis curvula Nassella trichotoma Paspalum dilatatum Phalaris aquatica <i>Carthamus lanatus</i> <i>Cirsium vulgare</i> <i>Echium plantagineum</i> <i>Hypericum perforatum</i> <i>Rosa rubiginosa</i> | 3.33 | 15.33 | 4.48 |
| Jarramlee | ACT01 | 3 | Ja_01.3.2 | 682593 | 6103344 | 10 | 4 | 3 | 0 | 13 | 0 | 0 | <i>Carthamus lanatus</i> <i>Hypericum perforatum</i> <i>Rosa rubiginosa</i> | 10.08 | 6.07 | 4.48 |
| Jarramlee | ACT01 | 3 | Ja_01.3.3 | 681735 | 6102769 | 6 | 0 | 1 | 0 | 18 | 4 | 5 - 25 | Festuca arundinacea Nassella neesiana Nassella trichotoma Paspalum dilatatum <i>Carthamus lanatus</i> <i>Echium plantagineum</i> <i>Rosa rubiginosa</i> <i>Rubus fruticosus</i> <i>Verbascum thapsus</i> | 1.80 | 18.27 | 4.48 |
| Jarramlee | ACT01 | 3 | Ja_01.3.4 | 682052 | 6103108 | 7 | 2 | 1 | 0 | 11 | 1 | 5 - 25 | Paspalum dilatatum <i>Carthamus lanatus</i> <i>Echium plantagineum</i> <i>Rubus fruticosus</i> | 3.54 | 9.93 | 4.48 |
| Jarramlee | ACT01 | 3 | Ja_01.3.5 | 682179 | 6103311 | 6 | 2 | 2 | 0 | 15 | 2 | 5 - 25 | Festuca arundinacea Paspalum dilatatum <i>Carthamus lanatus</i> <i>Hypericum perforatum</i> <i>Rubus fruticosus</i> | 3.64 | 12.61 | 4.48 |
| Jarramlee | ACT01 | 4 | Ja_01.4.1 | 681716 | 6102490 | 4 | 0 | 1 | 0 | 15 | 4 | 50 - 75 | Festuca arundinacea Nassella neesiana Paspalum dilatatum Phalaris aquatica <i>Carthamus lanatus</i> <i>Echium plantagineum</i> <i>Onopodium acanthium</i> | 0.82 | 18.15 | 1.69 |

| Site | PCT | Zone | Plot ID | Easting | Northing | Native spp | Indicator spp | Native non-grass spp | Threatened spp | Exotic spp | Significant weeds | Sig weed cover % (level 'X' weeds only) | Significant weed spp. (level 'X' weeds in bold) | Floristic Value Score | Weed Value Score | Zone FVS Average |
|-----------|-------|------|-----------|---------|----------|------------|---------------|----------------------|----------------|------------|-------------------|---|---|-----------------------|------------------|------------------|
| Jarramlee | ACT01 | 4 | Ja_01.4.2 | 681819 | 6103160 | 8 | 3 | 6 | 0 | 20 | 3 | 5 - 25 | Nassella neesiana Paspalum dilatatum Phalaris aquatica Carthamus lanatus Rubus fruticosus | 5.17 | 18.72 | 1.69 |
| Jarramlee | ACT01 | 4 | Ja_01.4.3 | 682550 | 6103645 | 4 | 0 | 0 | 0 | 13 | 3 | 5 - 25 | Eragrostis curvula Paspalum dilatatum Phalaris aquatica Echium plantagineum | 1.02 | 12.97 | 1.69 |
| Jarramlee | ACT01 | 4 | Ja_01.4.4 | 682503 | 6103016 | 2 | 0 | 1 | 0 | 15 | 3 | 50 - 75 | Festuca arundinacea Phalaris aquatica Nassella neesiana Echium plantagineum Hypericum perforatum | 0.40 | 16.81 | 1.69 |
| Jarramlee | ACT01 | 4 | Ja_01.4.5 | 682721 | 6103374 | 4 | 0 | 2 | 0 | 15 | 3 | 5 - 25 | Eragrostis curvula Paspalum dilatatum Phalaris aquatica Echium plantagineum | 1.02 | 13.01 | 1.69 |

Table A1-0-c. Kenny Grassland plot data summary

| Site | PCT | Zone | Plot ID | Easting | Northing | Native spp | Indicator spp | Native non-grass spp | Threatened spp | Exotic spp | Significant weeds | Sig weed cover % (level 'X' weeds only) | Significant weed spp. (level 'X' weeds in bold) | Floristic Value Score | Weed Value Score | Zone FVS Average |
|-----------------|-------|------|-----------|---------|----------|------------|---------------|----------------------|----------------|------------|-------------------|---|---|-----------------------|------------------|------------------|
| Kenny Grassland | ACT01 | 3 | KG_01.3.1 | 696602 | 6101266 | 5 | 0 | 0 | 0 | 9 | 0 | 0 | <i>Carthamus lanatus</i> <i>Echium plantagineum</i> <i>Onopodum acanthium</i> | 1.32 | 4.40 | 1.56 |
| Kenny Grassland | ACT01 | 3 | KG_01.3.2 | 696398 | 6101117 | 4 | 1 | 0 | 0 | 9 | 2 | 5 - 25 | <i>Nassella trichotoma</i> <i>Phalaris aquatica</i> <i>Echium plantagineum</i> <i>Onopodum acanthium</i> | 2.01 | 10.36 | 1.56 |
| Kenny Grassland | ACT01 | 3 | KG_01.3.3 | 696161 | 6100678 | 5 | 0 | 1 | 0 | 9 | 3 | 5 - 25 | <i>Eragrostis curvula</i> <i>Nassella trichotoma</i> <i>Phalaris aquatica</i> <i>Onopodum acanthium</i> | 1.50 | 12.59 | 1.56 |
| Kenny Grassland | ACT01 | 3 | KG_01.3.4 | 696196 | 6100563 | 6 | 0 | 2 | 0 | 7 | 3 | 5 - 25 | <i>Nassella trichotoma</i> <i>Paspalum dilatatum</i> <i>Phalaris aquatica</i> <i>Echium plantagineum</i> | 1.42 | 9.99 | 1.56 |
| Kenny Grassland | ACT01 | 4 | KG_01.4.1 | 696121 | 6101313 | 4 | 0 | 0 | 0 | 6 | 2 | 50 - 75 | <i>Nassella trichotoma</i> <i>Phalaris aquatica</i> <i>Hypericum perforatum</i> | 1.00 | 6.59 | 0.99 |
| Kenny Grassland | ACT01 | 4 | KG_01.4.2 | 696020 | 6101046 | 3 | 0 | 1 | 0 | 16 | 4 | > 75 | <i>Eragrostis curvula</i> <i>Nassella trichotoma</i> <i>Paspalum dilatatum</i> <i>Phalaris aquatica</i> <i>Echium plantagineum</i> | 0.72 | 15.85 | 0.99 |
| Kenny Grassland | ACT01 | 4 | KG_01.4.3 | 696272 | 6100992 | 4 | 0 | 1 | 0 | 7 | 2 | 50 - 75 | <i>Paspalum dilatatum</i> <i>Phalaris aquatica</i> | 1.02 | 10.26 | 0.99 |
| Kenny Grassland | ACT01 | 4 | KG_01.4.4 | 695965 | 6100386 | 4 | 0 | 0 | 0 | 9 | 3 | 25 - 50 | <i>Nassella trichotoma</i> <i>Paspalum dilatatum</i> <i>Phalaris aquatica</i> <i>Echium plantagineum</i> | 1.20 | 13.29 | 0.99 |

Table A1-0-d. Majura West Grassland plot data summary

| Site | PCT | Zone | Plot ID | Easting | Northing | Native spp | Indicator spp | Native non-grass spp | Threatened spp | Exotic spp | Significant weeds | Sig weed cover % (level 'X' weeds only) | Significant weed spp. (level 'X' weeds in bold) | Floristic Value Score | Weed Value Score | Zone FVS Average |
|-----------------------|-------|------|-----------|---------|----------|------------|---------------|----------------------|----------------|------------|-------------------|---|---|-----------------------|------------------|------------------|
| Majura West Grassland | ACT01 | 1 | MW_01.1.1 | 698531 | 6094264 | 15 | 6 | 10 | 0 | 7 | 1 | < 5 | Nassella trichotoma <i>Hypericum perforatum</i> <i>Carthamus lanatus</i> | 21.66 | 7.93 | 24.45 |
| Majura West Grassland | ACT01 | 1 | MW_01.1.2 | 698210 | 6094055 | 20 | 8 | 15 | 0 | 5 | 0 | 0 | <i>Hypericum perforatum</i> | 29.47 | 2.30 | 24.45 |
| Majura West Grassland | ACT01 | 1 | MW_01.1.3 | 697988 | 6093476 | 19 | 6 | 12 | 0 | 5 | 0 | 0 | <i>Hypericum perforatum</i> | 24.58 | 2.70 | 24.45 |
| Majura West Grassland | ACT01 | 1 | MW_01.1.4 | 698306 | 6093168 | 15 | 6 | 9 | 0 | 6 | 1 | < 5 | Nassella trichotoma <i>Carthamus lanatus</i> | 22.08 | 6.33 | 24.45 |
| Majura West Grassland | ACT01 | 2 | MW_01.2.1 | 698274 | 6094006 | 14 | 3 | 7 | 0 | 9 | 1 | < 5 | Nassella trichotoma <i>Carthamus lanatus</i> <i>Hypericum perforatum</i> <i>Rosa rubiginosa</i> | 9.78 | 6.34 | 8.83 |
| Majura West Grassland | ACT01 | 2 | MW_01.2.2 | 698390 | 6094131 | 12 | 2 | 4 | 0 | 5 | 0 | 0 | <i>Carthamus lanatus</i> <i>Cirsium vulgare</i> <i>Hypericum perforatum</i> | 7.88 | 4.30 | 8.83 |
| Majura West Grassland | ACT01 | 3 | MW_01.3.1 | 698535 | 6094453 | 6 | 1 | 4 | 0 | 10 | 3 | < 5 | Nassella neesiana Nassella trichotoma Phalaris aquatica <i>Hypericum perforatum</i> <i>Carthamus lanatus</i> <i>Cirsium vulgare</i> | 2.68 | 12.92 | 3.20 |
| Majura West Grassland | ACT01 | 3 | MW_01.3.2 | 698425 | 6094022 | 10 | 0 | 5 | 0 | 6 | 2 | < 5 | Nassella neesiana Nassella trichotoma <i>Carthamus lanatus</i> <i>Cirsium vulgare</i> | 2.99 | 7.84 | 3.20 |
| Majura West Grassland | ACT01 | 3 | MW_01.3.3 | 698380 | 6093920 | 6 | 1 | 4 | 0 | 8 | 1 | < 5 | Nassella trichotoma <i>Carthamus lanatus</i> <i>Cirsium vulgare</i> <i>Hypericum perforatum</i> <i>Rosa rubiginosa</i> | 3.33 | 6.26 | 3.20 |
| Majura West Grassland | ACT01 | 3 | MW_01.3.4 | 698307 | 6093426 | 9 | 2 | 3 | 0 | 10 | 2 | < 5 | Nassella neesiana Nassella trichotoma <i>Cirsium vulgare</i> | 3.78 | 12.66 | 3.20 |

| Site | PCT | Zone | Plot ID | Easting | Northing | Native spp | Indicator spp | Native non-grass spp | Threatened spp | Exotic spp | Significant weeds | Sig weed cover % (level 'X' weeds only) | Significant weed spp. (level 'X' weeds in bold) | Floristic Value Score | Weed Value Score | Zone FVS Average |
|-----------------------|-------|------|-----------|---------|----------|------------|---------------|----------------------|----------------|------------|-------------------|---|--|-----------------------|------------------|------------------|
| Majura West Grassland | ACT01 | 4 | MW_01.4.1 | 698671 | 6094889 | 2 | 0 | 1 | 0 | 11 | 2 | 50 - 75 | Nassella trichotoma Phalaris aquatica <i>Hypericum perforatum</i> <i>Carthamus lanatus</i> <i>Cirsium vulgare</i> <i>Rosa rubiginosa</i> | 0.60 | 8.69 | 2.09 |
| Majura West Grassland | ACT01 | 4 | MW_01.4.2 | 698704 | 6094213 | 6 | 0 | 5 | 0 | 5 | 1 | 50 - 75 | Phalaris aquatica <i>Hypericum perforatum</i> <i>Rosa rubiginosa</i> | 3.02 | 4.60 | 2.09 |
| Majura West Grassland | ACT01 | 4 | MW_01.4.3 | 698637 | 6093489 | 3 | 0 | 3 | 0 | 14 | 3 | 5 - 25 | Festuca arundinacea Nassella neesiana Phalaris aquatica <i>Centaurea calcitrapa</i> <i>Cirsium vulgare</i> <i>Onopodum acanthium</i> | 1.42 | 16.79 | 2.09 |
| Majura West Grassland | ACT01 | 4 | MW_01.4.4 | 697944 | 6093405 | 6 | 1 | 3 | 0 | 15 | 2 | 50 - 75 | Festuca arundinacea Nassella neesiana <i>Carthamus lanatus</i> <i>Cirsium vulgare</i> <i>Rosa rubiginosa</i> | 3.31 | 12.79 | 2.09 |

Table A1-0-e. West Macgregor plot data summary

| Site | PCT | Zone | Plot ID | Easting | Northing | Native spp | Indicator spp | Native non-grass spp | Threatened spp | Exotic spp | Significant weeds | Sig weed cover % (level 'X' weeds only) | Significant weed spp. (level 'X' weeds in bold) | Floristic Value Score | Weed Value Score | Zone FVS Average |
|----------------|-------|------|-----------|---------|----------|------------|---------------|----------------------|----------------|------------|-------------------|---|---|-----------------------|------------------|------------------|
| West Macgregor | ACT01 | 3 | WM_01.3.1 | 682593 | 6102913 | 7 | 0 | 2 | 0 | 16 | 2 | < 5 | Nassella neesiana Paspalum dilatatum <i>Echium plantagineum</i> <i>Hypericum perforatum</i> | 2.20 | 11.76 | 1.64 |
| West Macgregor | ACT01 | 3 | WM_01.3.2 | 682833 | 6102802 | 4 | 0 | 0 | 0 | 15 | 2 | < 5 | Nassella trichotoma Paspalum dilatatum <i>Carthamus lanatus</i> <i>Cirsium vulgare</i> <i>Echium plantagineum</i> | 1.20 | 12.16 | 1.64 |
| West Macgregor | ACT01 | 3 | WM_01.3.3 | 682670 | 6102697 | 6 | 0 | 1 | 0 | 10 | 3 | < 5 | Nassella neesiana Nassella trichotoma Paspalum dilatatum <i>Hypericum perforatum</i> <i>Rosa rubiginosa</i> | 1.62 | 12.17 | 1.64 |
| West Macgregor | ACT01 | 3 | WM_01.3.4 | 682824 | 6102459 | 5 | 0 | 1 | 0 | 13 | 3 | < 5 | Nassella neesiana Nassella trichotoma Paspalum dilatatum <i>Carthamus lanatus</i> <i>Echium plantagineum</i> <i>Rosa rubiginosa</i> | 1.53 | 13.99 | 1.64 |
| West Macgregor | ACT01 | 4 | WM_01.4.1 | 682832 | 6102985 | 4 | 0 | 1 | 0 | 16 | 2 | < 5 | Nassella trichotoma Phalaris aquatica <i>Carthamus lanatus</i> <i>Echium plantagineum</i> | 1.02 | 11.18 | 1.01 |
| West Macgregor | ACT01 | 4 | WM_01.4.2 | 682939 | 6102955 | 6 | 0 | 2 | 0 | 12 | 4 | 5 - 25 | Festuca arundinacea Nassella neesiana Paspalum dilatatum Phalaris aquatica <i>Echium plantagineum</i> | 1.60 | 16.35 | 1.01 |
| West Macgregor | ACT01 | 4 | WM_01.4.3 | 682711 | 6102586 | 5 | 0 | 1 | 0 | 16 | 4 | 25 - 50 | Eragrostis curvula Festuca arundinacea Nassella neesiana Paspalum dilatatum <i>Carthamus lanatus</i> <i>Cirsium vulgare</i> <i>Echium plantagineum</i> <i>Rosa rubiginosa</i> <i>Rubus fruticosus</i> | 1.30 | 16.43 | 1.01 |

| Site | PCT | Zone | Plot ID | Easting | Northing | Native spp | Indicator spp | Native non-grass spp | Threatened spp | Exotic spp | Significant weeds | Sig weed cover % (level 'X' weeds only) | Significant weed spp. (level 'X' weeds in bold) | Floristic Value Score | Weed Value Score | Zone FVS Average |
|----------------|-------|------|-----------|---------|----------|------------|---------------|----------------------|----------------|------------|-------------------|---|---|-----------------------|------------------|------------------|
| West Macgregor | ACT01 | 4 | WM_01.4.4 | 683028 | 6102606 | 1 | 0 | 1 | 0 | 9 | 3 | > 75 | <i>Eragrostis curvula</i> <i>Nassella neesiana</i> <i>Phalaris aquatica</i> <i>Echium plantagineum</i> | 0.12 | 10.12 | 1.01 |

Table A1-0-f. Woolshed Creek plot data summary

| Site | PCT | Zone | Plot ID | Easting | Northing | Native spp | Indicator spp | Native non-grass spp | Threatened spp | Exotic spp | Significant weeds | Sig weed cover % (level 'X' weeds only) | Significant weed spp. (level 'X' weeds in bold) | Floristic Value Score | Weed Value Score | Zone FVS Average |
|----------------|-------|------|-----------|---------|----------|------------|---------------|----------------------|----------------|------------|-------------------|---|---|-----------------------|------------------|------------------|
| Woolshed Creek | ACT01 | 3 | WC_01.3.1 | 699114 | 6092788 | 4 | 0 | 1 | 0 | 10 | 3 | < 5 | Festuca arundinacea Nassella neesiana Paspalum dilatatum Carthamus lanatus Onopodum acanthium | 1.20 | 7.77 | 1.37 |
| Woolshed Creek | ACT01 | 3 | WC_01.3.2 | 698899 | 6092723 | 5 | 0 | 1 | 0 | 14 | 4 | < 5 | Eragrostis curvula Nassella neesiana Nassella trichotoma Paspalum aquatica Cirsium vulgare Carthamus lanatus Onopodum acanthium | 1.32 | 13.18 | 1.37 |
| Woolshed Creek | ACT01 | 3 | WC_01.3.3 | 698889 | 6092415 | 7 | 0 | 2 | 0 | 10 | 2 | < 5 | Festuca arundinacea Paspalum dilatatum Carthamus lanatus | 1.95 | 5.84 | 1.37 |
| Woolshed Creek | ACT01 | 3 | WC_01.3.4 | 698395 | 6091837 | 4 | 0 | 2 | 0 | 14 | 1 | 5 - 25 | Nassella neesiana Echium plantagineum | 1.02 | 10.83 | 1.37 |
| Woolshed Creek | ACT01 | 4 | WC_01.4.1 | 698599 | 6092828 | 4 | 0 | 4 | 0 | 12 | 3 | > 75 | Nassella neesiana Paspalum dilatatum Phalaris aquatica Centaurea calcitrapa | 1.52 | 16.01 | 0.77 |
| Woolshed Creek | ACT01 | 4 | WC_01.4.2 | 698248 | 6091700 | 1 | 0 | 1 | 0 | 13 | 3 | 25 - 50 | Nassella trichotoma Paspalum dilatatum Phalaris aquatica | 0.30 | WC_01.4.2 | 0.77 |
| Woolshed Creek | ACT01 | 4 | WC_01.4.3 | 698644 | 6092377 | 2 | 0 | 0 | 0 | 11 | 4 | 50 - 75 | Festuca arundinacea Nassella neesiana Paspalum dilatatum Phalaris aquatica Carthamus lanatus Centaurea calcitrapa | 0.40 | 17.62 | 0.77 |
| Woolshed Creek | ACT01 | 4 | WC_01.4.4 | 698755 | 6091804 | 4 | 0 | 3 | 0 | 13 | 4 | 25 - 50 | Festuca arundinacea Nassella neesiana Paspalum dilatatum Carthamus lanatus | 0.85 | 16.82 | 0.77 |

Table A1-0-g. Yass Valley Lot 2 plot data summary

| Site | PCT | Zone | Plot ID | Easting | Northing | Native spp | Indicator spp | Native non-grass spp | Threatened spp | Exotic spp | Significant weeds | Sig weed cover % (level 'X' weeds only) | Significant weed spp. (level 'X' weeds in bold) | Floristic Value Score | Weed Value Score | Zone FVS Average |
|-------------------|-------|------|-----------|---------|----------|------------|---------------|----------------------|-------------------------------------|------------|-------------------|---|--|-----------------------|------------------|------------------|
| Yass Valley Lot 2 | ACT01 | 1 | YV_01.1.1 | 682967 | 6104236 | 20 | 8 | 7 | 1 (<i>Dianella longifolia</i>) | 11 | 1 | < 5 | <i>Paspalum dilatatum</i> <i>Carthamus lanatus</i> <i>Echium plantagineum</i> | 22.44 | 6.44 | 18.79 |
| Yass Valley Lot 2 | ACT01 | 1 | YV_01.1.2 | 683203 | 6105176 | 14 | 4 | 7 | 0 | 14 | 3 | < 5 | <i>Festuca arundinacea</i> <i>Nassella neesiana</i> <i>Phalaris aquatica</i> <i>Cirsium vulgare</i> <i>Hypericum perforatum</i> <i>Rosa rubiginosa</i> | 13.10 | 11.40 | 18.79 |
| Yass Valley Lot 2 | ACT01 | 1 | YV_01.1.3 | 684591 | 6105170 | 19 | 7 | 8 | 0 | 8 | 0 | 0 | <i>Carthamus lanatus</i> | 23.49 | 3.30 | 18.79 |
| Yass Valley Lot 2 | ACT01 | 1 | YV_01.1.4 | 683844 | 6104739 | 16 | 5 | 9 | 0 | 10 | 0 | 0 | <i>Cirsium vulgare</i> <i>Rosa rubiginosa</i> | 16.12 | 5.27 | 18.79 |
| Yass Valley Lot 2 | ACT01 | 3 | YV_01.3.1 | 682958 | 6104552 | 6 | 0 | 2 | 0 | 9 | 0 | 0 | <i>Carthamus lanatus</i> <i>Echium plantagineum</i> | 1.63 | 4.75 | 1.87 |
| Yass Valley Lot 2 | ACT01 | 3 | YV_01.3.2 | 683001 | 6104703 | 8 | 0 | 1 | 0 | 9 | 0 | 0 | <i>Echium plantagineum</i> | 2.25 | 4.03 | 1.87 |
| Yass Valley Lot 2 | ACT01 | 3 | YV_01.3.3 | 683321 | 6105036 | 9 | 0 | 2 | 0 | 8 | 3 | < 5 | <i>Nassella trichotoma</i> <i>Paspalum dilatatum</i> <i>Phalaris aquatica</i> <i>Verbascum thapsus</i> | 2.20 | 8.70 | 1.87 |
| Yass Valley Lot 2 | ACT01 | 3 | YV_01.3.4 | 683783 | 6104744 | 6 | 0 | 2 | 0 | 8 | 0 | 0 | <i>Cirsium vulgare</i> | 1.40 | 5.23 | 1.87 |
| Yass Valley Lot 2 | ACT01 | 4 | YV_01.4.1 | 683626 | 6104620 | 0 | 0 | 0 | 0 | 6 | 2 | > 75 | <i>Paspalum dilatatum</i> <i>Phalaris aquatica</i> | 0.00 | 8.56 | 0.43 |
| Yass Valley Lot 2 | ACT01 | 4 | YV_01.4.2 | 683348 | 6104909 | 0 | 0 | 0 | 0 | 6 | 2 | > 75 | <i>Paspalum dilatatum</i> <i>Phalaris aquatica</i> | 0.00 | 6.59 | 0.43 |
| Yass Valley Lot 2 | ACT01 | 4 | YV_01.4.3 | 683105 | 6104976 | 2 | 0 | 0 | 0 | 5 | 1 | 25 - 50 | <i>Phalaris aquatica</i> | 0.60 | 6.63 | 0.43 |
| Yass Valley Lot 2 | ACT01 | 4 | YV_01.4.4 | 683418 | 6104427 | 5 | 0 | 1 | 0 | 9 | 2 | 5 - 25 | <i>Paspalum dilatatum</i> <i>Phalaris aquatica</i> | 1.10 | 9.59 | 0.43 |

Appendix 2. Step-Point Transect Data Summary Table

Table A2-0-a. Transect data summary

| Site | PCT | Zone | Transect ID | Datum and Zone | Start Easting | Start Northing | End Easting | End Northing | Length (m) | Crypt | Bare | Rock | Litter | Ann Ex Grass | Per Ex Grass | Ex Broadleaf | Per Native Grass | Other Native | Percent Perennial Native |
|-----------|-------|------|-------------|----------------|---------------|----------------|-------------|--------------|------------|-------|------|------|--------|--------------|--------------|--------------|------------------|--------------|--------------------------|
| Bonshaw | ACT01 | 1 | Bo_01.1.1 | MGA Zone 55 | 698946 | 6085830 | 698926 | 6085875 | 50 | 0 | 10 | 1 | 1 | 0 | 0 | 1 | 32 | 5 | 97 |
| Bonshaw | ACT01 | 1 | Bo_01.1.2 | MGA Zone 55 | 699000 | 6085774 | 699032 | 6085812 | 50 | 5 | 7 | 0 | 1 | 0 | 0 | 0 | 32 | 7 | 100 |
| Bonshaw | ACT01 | 1 | Bo_01.1.3 | MGA Zone 55 | 699602 | 6085640 | 699558 | 6085616 | 50 | 0 | 12 | 1 | 3 | 0 | 1 | 12 | 14 | 7 | 62 |
| Bonshaw | ACT01 | 2 | Bo_01.2.1 | MGA Zone 55 | 699401 | 6085430 | 699365 | 6085396 | 50 | 5 | 8 | 0 | 3 | 0 | 0 | 3 | 28 | 3 | 91 |
| Bonshaw | ACT01 | 2 | Bo_01.2.2 | MGA Zone 55 | 697431 | 6084043 | 697481 | 6084051 | 50 | 0 | 3 | 0 | 12 | 0 | 0 | 8 | 22 | 5 | 77 |
| Bonshaw | ACT01 | 3 | Bo_01.3.1 | MGA Zone 55 | 698471 | 6085998 | 698521 | 6085988 | 50 | 0 | 10 | 0 | 1 | 1 | 1 | 4 | 33 | 0 | 87 |
| Bonshaw | ACT01 | 3 | Bo_01.3.2 | MGA Zone 55 | 698513 | 6085672 | 698504 | 6085721 | 50 | 0 | 2 | 0 | 3 | 1 | 0 | 4 | 40 | 0 | 91 |
| Bonshaw | ACT01 | 3 | Bo_01.3.3 | MGA Zone 55 | 699030 | 6085486 | 699075 | 6085465 | 50 | 0 | 0 | 0 | 14 | 4 | 0 | 7 | 25 | 0 | 78 |
| Bonshaw | ACT01 | 3 | Bo_01.3.4 | MGA Zone 55 | 698519 | 6084950 | 698563 | 6084972 | 50 | 0 | 0 | 0 | 13 | 0 | 8 | 2 | 27 | 0 | 73 |
| Bonshaw | ACT01 | 3 | Bo_01.3.5 | MGA Zone 55 | 698229 | 6084769 | 698277 | 6084781 | 50 | 0 | 0 | 0 | 10 | 0 | 4 | 13 | 23 | 0 | 58 |
| Bonshaw | ACT01 | 3 | Bo_01.3.6 | MGA Zone 55 | 697780 | 6084584 | 697790 | 6084633 | 50 | 0 | 0 | 0 | 14 | 0 | 15 | 3 | 20 | 0 | 53 |
| Bonshaw | ACT01 | 3 | Bo_01.3.7 | MGA Zone 55 | 698318 | 6084330 | 698367 | 6084319 | 50 | 0 | 1 | 0 | 9 | 1 | 0 | 7 | 33 | 0 | 83 |
| Bonshaw | ACT01 | 3 | Bo_01.3.8 | MGA Zone 55 | 696996 | 6084395 | 697046 | 6084394 | 50 | 0 | 1 | 0 | 11 | 0 | 7 | 8 | 30 | 1 | 67 |
| Bonshaw | ACT01 | 3 | Bo_01.3.9 | MGA Zone 55 | 697370 | 6084334 | 697358 | 6084285 | 50 | 0 | 1 | 0 | 11 | 1 | 0 | 12 | 28 | 0 | 70 |
| Bonshaw | ACT01 | 3 | Bo_01.3.10 | MGA Zone 55 | 697985 | 6083870 | 698034 | 6083864 | 50 | 0 | 2 | 0 | 17 | 1 | 6 | 6 | 19 | 0 | 61 |
| Bonshaw | ACT01 | 4 | Bo_01.4.1 | MGA Zone 55 | 699233 | 6085398 | 699283 | 6085404 | 50 | 0 | 0 | 0 | 0 | 2 | 35 | 5 | 2 | 6 | 17 |
| Bonshaw | ACT01 | 4 | Bo_01.4.2 | MGA Zone 55 | 698827 | 6085280 | 698814 | 6085231 | 50 | 0 | 0 | 0 | 14 | 25 | 0 | 13 | 0 | 0 | 0 |
| Bonshaw | ACT01 | 4 | Bo_01.4.3 | MGA Zone 55 | 698235 | 6084186 | 698281 | 6084168 | 50 | 0 | 0 | 0 | 11 | 2 | 33 | 2 | 0 | 2 | 5 |
| Bonshaw | ACT01 | 4 | Bo_01.4.4 | MGA Zone 55 | 697795 | 6084010 | 697782 | 6083962 | 50 | 0 | 1 | 0 | 8 | 7 | 26 | 8 | 0 | 3 | 8 |
| Jarramlee | ACT01 | 1 | Ja_01.1.1 | MGA Zone 55 | 681593 | 6102707 | 681558 | 6102743 | 50 | 7 | 0 | 4 | 2 | 1 | 1 | 1 | 33 | 2 | 95 |
| Jarramlee | ACT01 | 1 | Ja_01.1.2 | MGA Zone 55 | 681725 | 6102532 | 681676 | 6102544 | 50 | 1 | 0 | 4 | 3 | 0 | 0 | 3 | 39 | 0 | 93 |
| Jarramlee | ACT01 | 1 | Ja_01.1.3 | MGA Zone 55 | 681864 | 6102764 | 681883 | 6102717 | 50 | 2 | 5 | 2 | 5 | 2 | 0 | 2 | 32 | 0 | 94 |
| Jarramlee | ACT01 | 1 | Ja_01.1.4 | MGA Zone 55 | 681768 | 6102670 | 681772 | 6102620 | 50 | 0 | 0 | 5 | 4 | 2 | 0 | 4 | 35 | 0 | 90 |
| Jarramlee | ACT01 | 2 | Ja_01.2.1 | MGA Zone 55 | 681451 | 6102926 | 681424 | 6102883 | 50 | 1 | 1 | 0 | 2 | 2 | 2 | 9 | 32 | 1 | 75 |
| Jarramlee | ACT01 | 2 | Ja_01.2.2 | MGA Zone 55 | 682488 | 6103586 | 682512 | 6103542 | 50 | 1 | 0 | 0 | 7 | 0 | 0 | 1 | 41 | 0 | 98 |
| Jarramlee | ACT01 | 2 | Ja_01.2.3 | MGA Zone 55 | 682495 | 6103505 | 682543 | 6103491 | 50 | 3 | 0 | 0 | 4 | 1 | 10 | 1 | 30 | 1 | 74 |
| Jarramlee | ACT01 | 2 | Ja_01.2.4 | MGA Zone 55 | 682384 | 6103588 | 682431 | 6103605 | 50 | 0 | 0 | 0 | 5 | 2 | 3 | 2 | 38 | 0 | 88 |
| Jarramlee | ACT01 | 2 | Ja_01.2.5 | MGA Zone 55 | 682099 | 6102993 | 682053 | 6102973 | 50 | 0 | 0 | 1 | 4 | 0 | 2 | 2 | 40 | 0 | 91 |
| Jarramlee | ACT01 | 3 | Ja_01.3.1 | MGA Zone 55 | 681497 | 6102772 | 681494 | 6102822 | 50 | 0 | 0 | 0 | 13 | 1 | 6 | 6 | 24 | 0 | 67 |
| Jarramlee | ACT01 | 3 | Ja_01.3.2 | MGA Zone 55 | 682577 | 6103336 | 682610 | 6103298 | 50 | 1 | 0 | 0 | 3 | 7 | 2 | 1 | 32 | 1 | 92 |
| Jarramlee | ACT01 | 3 | Ja_01.3.3 | MGA Zone 55 | 681738 | 6102770 | 681779 | 6102800 | 50 | 0 | 0 | 0 | 7 | 8 | 2 | 7 | 26 | 0 | 74 |

| Site | PCT | Zone | Transect ID | Datum and Zone | Start Easting | Start Northing | End Easting | End Northing | Length (m) | Crypt | Bare | Rock | Litter | Ann Ex Grass | Per Ex Grass | Ex Broadleaf | Per Native Grass | Other Native | Percent Perennial Native |
|-----------------------|-------|------|-------------|----------------|---------------|----------------|-------------|--------------|------------|-------|------|------|--------|--------------|--------------|--------------|------------------|--------------|--------------------------|
| Jarramlee | ACT01 | 3 | Ja_01.3.4 | MGA Zone 55 | 682066 | 6103122 | 682057 | 6103073 | 50 | 0 | 2 | 0 | 5 | 7 | 14 | 2 | 20 | 0 | 56 |
| Jarramlee | ACT01 | 3 | Ja_01.3.5 | MGA Zone 55 | 682193 | 6103326 | 682208 | 6103278 | 50 | 0 | 1 | 0 | 9 | 11 | 7 | 4 | 20 | 0 | 65 |
| Jarramlee | ACT01 | 4 | Ja_01.4.1 | MGA Zone 55 | 681717 | 6102492 | 681702 | 6102444 | 50 | 0 | 0 | 0 | 10 | 2 | 31 | 4 | 2 | 1 | 8 |
| Jarramlee | ACT01 | 4 | Ja_01.4.2 | MGA Zone 55 | 681834 | 6103137 | 681809 | 6103180 | 50 | 0 | 0 | 0 | 8 | 7 | 11 | 18 | 6 | 0 | 17 |
| Jarramlee | ACT01 | 4 | Ja_01.4.3 | MGA Zone 55 | 682547 | 6103648 | 682596 | 6103639 | 50 | 0 | 0 | 0 | 6 | 5 | 32 | 3 | 4 | 0 | 10 |
| Jarramlee | ACT01 | 4 | Ja_01.4.4 | MGA Zone 55 | 682501 | 6103010 | 682454 | 6102995 | 50 | 0 | 0 | 0 | 6 | 0 | 43 | 2 | 0 | 0 | 0 |
| Jarramlee | ACT01 | 4 | Ja_01.4.5 | MGA Zone 55 | 682720 | 6103375 | 682769 | 6103363 | 50 | 0 | 0 | 0 | 1 | 3 | 45 | 0 | 2 | 0 | 4 |
| Kenny Grassland | ACT01 | 3 | KG_01.3.1 | MGA Zone 55 | 696602 | 6101271 | 696563 | 6101241 | 50 | 0 | 1 | 0 | 12 | 0 | 10 | 2 | 25 | 0 | 68 |
| Kenny Grassland | ACT01 | 3 | KG_01.3.2 | MGA Zone 55 | 696380 | 6101104 | 696423 | 6101130 | 50 | 0 | 1 | 0 | 12 | 2 | 6 | 10 | 19 | 0 | 54 |
| Kenny Grassland | ACT01 | 3 | KG_01.3.3 | MGA Zone 55 | 696170 | 6100680 | 696201 | 6100641 | 50 | 0 | 1 | 0 | 13 | 0 | 11 | 1 | 24 | 0 | 67 |
| Kenny Grassland | ACT01 | 3 | KG_01.3.4 | MGA Zone 55 | 696184 | 6100565 | 696234 | 6100560 | 50 | 0 | 1 | 0 | 18 | 0 | 4 | 5 | 22 | 0 | 71 |
| Kenny Grassland | ACT01 | 4 | KG_01.4.1 | MGA Zone 55 | 696119 | 6101302 | 696167 | 6101290 | 50 | 0 | 0 | 0 | 10 | 1 | 30 | 2 | 7 | 0 | 18 |
| Kenny Grassland | ACT01 | 4 | KG_01.4.2 | MGA Zone 55 | 696034 | 6101041 | 696081 | 6101023 | 50 | 0 | 3 | 0 | 0 | 0 | 43 | 4 | 0 | 0 | 0 |
| Kenny Grassland | ACT01 | 4 | KG_01.4.3 | MGA Zone 55 | 696271 | 6100985 | 696318 | 6100968 | 50 | 0 | 0 | 0 | 1 | 0 | 38 | 1 | 6 | 4 | 20 |
| Kenny Grassland | ACT01 | 4 | KG_01.4.4 | MGA Zone 55 | 695962 | 6100388 | 695995 | 6100427 | 50 | 0 | 0 | 0 | 8 | 3 | 29 | 2 | 8 | 0 | 21 |
| Majura West Grassland | ACT01 | 1 | MW_01.1.1 | MGA Zone 55 | 698538 | 6094247 | 698491 | 6094264 | 50 | 6 | 10 | 0 | 2 | 0 | 0 | 2 | 28 | 2 | 94 |
| Majura West Grassland | ACT01 | 1 | MW_01.1.2 | MGA Zone 55 | 698207 | 6094062 | 698228 | 6094016 | 50 | 5 | 11 | 0 | 1 | 0 | 0 | 6 | 22 | 5 | 82 |
| Majura West Grassland | ACT01 | 1 | MW_01.1.3 | MGA Zone 55 | 697997 | 6093487 | 698039 | 6093459 | 50 | 1 | 8 | 0 | 2 | 0 | 0 | 15 | 19 | 5 | 62 |
| Majura West Grassland | ACT01 | 1 | MW_01.1.4 | MGA Zone 55 | 698291 | 6093160 | 698339 | 6093149 | 50 | 0 | 8 | 0 | 4 | 0 | 1 | 12 | 16 | 9 | 66 |
| Majura West Grassland | ACT01 | 2 | MW_01.2.1 | MGA Zone 55 | 698266 | 6093992 | 698286 | 6093946 | 50 | 0 | 5 | 0 | 10 | 0 | 0 | 9 | 26 | 0 | 74 |
| Majura West Grassland | ACT01 | 2 | MW_01.2.2 | MGA Zone 55 | 698382 | 6094131 | 698405 | 6094176 | 50 | 0 | 2 | 0 | 17 | 0 | 0 | 11 | 16 | 5 | 66 |
| Majura West Grassland | ACT01 | 3 | MW_01.3.1 | MGA Zone 55 | 698537 | 6094451 | 698568 | 6094412 | 50 | 0 | 2 | 0 | 18 | 2 | 0 | 12 | 16 | 0 | 57 |
| Majura West Grassland | ACT01 | 3 | MW_01.3.2 | MGA Zone 55 | 698423 | 6094022 | 698402 | 6093977 | 50 | 0 | 3 | 0 | 18 | 0 | 0 | 10 | 18 | 1 | 66 |
| Majura West Grassland | ACT01 | 3 | MW_01.3.3 | MGA Zone 55 | 698381 | 6093922 | 698337 | 6093897 | 50 | 0 | 1 | 0 | 26 | 0 | 2 | 5 | 14 | 2 | 70 |
| Majura West Grassland | ACT01 | 3 | MW_01.3.4 | MGA Zone 55 | 698303 | 6093411 | 698329 | 6093454 | 50 | 0 | 1 | 0 | 15 | 5 | 6 | 10 | 16 | 1 | 52 |
| Majura West Grassland | ACT01 | 4 | MW_01.4.2 | MGA Zone 55 | 698673 | 6094894 | 698721 | 6094879 | 50 | 0 | 0 | 0 | 7 | 0 | 42 | 1 | 0 | 0 | 0 |
| Majura West Grassland | ACT01 | 4 | MW_01.4.1 | MGA Zone 55 | 698724 | 6094215 | 698742 | 6094169 | 50 | 0 | 0 | 0 | 0 | 0 | 47 | 0 | 0 | 3 | 6 |

| Site | PCT | Zone | Transect ID | Datum and Zone | Start Easting | Start Northing | End Easting | End Northing | Length (m) | Crypt | Bare | Rock | Litter | Ann Ex Grass | Per Ex Grass | Ex Broadleaf | Per Native Grass | Other Native | Percent Perennial Native |
|-----------------------|-------|------|-------------|----------------|---------------|----------------|-------------|--------------|------------|-------|------|------|--------|--------------|--------------|--------------|------------------|--------------|--------------------------|
| Majura West Grassland | ACT01 | 4 | MW_01.4.3 | MGA Zone 55 | 698632 | 6093490 | 698619 | 6093442 | 50 | 0 | 1 | 0 | 3 | 7 | 20 | 18 | 0 | 1 | 3 |
| Majura West Grassland | ACT01 | 4 | MW_01.4.4 | MGA Zone 55 | 697955 | 6093406 | 697984 | 6093365 | 50 | 0 | 1 | 0 | 1 | 0 | 25 | 21 | 2 | 0 | 4 |
| West Macgregor | ACT01 | 3 | WM_01.3.1 | MGA Zone 55 | 682588 | 6102912 | 682540 | 6102900 | 50 | 0 | 0 | 0 | 5 | 5 | 0 | 4 | 36 | 0 | 90 |
| West Macgregor | ACT01 | 3 | WM_01.3.2 | MGA Zone 55 | 682825 | 6102800 | 682833 | 6102751 | 50 | 0 | 2 | 0 | 8 | 3 | 7 | 7 | 23 | 0 | 62 |
| West Macgregor | ACT01 | 3 | WM_01.3.3 | MGA Zone 55 | 682667 | 6102695 | 682624 | 6102670 | 50 | 0 | 0 | 0 | 11 | 3 | 9 | 5 | 27 | 0 | 55 |
| West Macgregor | ACT01 | 3 | WM_01.3.4 | MGA Zone 55 | 682822 | 6102458 | 682775 | 6102441 | 50 | 0 | 0 | 0 | 15 | 3 | 9 | 4 | 19 | 0 | 59 |
| West Macgregor | ACT01 | 4 | WM_01.4.1 | MGA Zone 55 | 682839 | 6102986 | 682857 | 6102939 | 50 | 0 | 0 | 0 | 11 | 7 | 25 | 7 | 0 | 0 | 0 |
| West Macgregor | ACT01 | 4 | WM_01.4.3 | MGA Zone 55 | 682944 | 6102933 | 682933 | 6102885 | 50 | 0 | 0 | 0 | 8 | 0 | 35 | 5 | 1 | 1 | 5 |
| West Macgregor | ACT01 | 4 | WM_01.4.3 | MGA Zone 55 | 682709 | 6102574 | 682686 | 6102530 | 50 | 0 | 0 | 0 | 3 | 1 | 29 | 13 | 0 | 5 | 11 |
| West Macgregor | ACT01 | 4 | WM_01.4.4 | MGA Zone 55 | 683033 | 6102609 | 683024 | 6102658 | 50 | 0 | 0 | 0 | 0 | 4 | 44 | 2 | 0 | 0 | 0 |
| Woolshed Creek | ACT01 | 3 | WC_01.3.1 | MGA Zone 55 | 699135 | 6092782 | 699123 | 6092733 | 50 | 0 | 0 | 0 | 7 | 11 | 3 | 7 | 27 | 0 | 73 |
| Woolshed Creek | ACT01 | 3 | WC_01.3.2 | MGA Zone 55 | 698908 | 6092726 | 698957 | 6092735 | 50 | 0 | 0 | 0 | 12 | 2 | 9 | 7 | 21 | 0 | 57 |
| Woolshed Creek | ACT01 | 3 | WC_01.3.3 | MGA Zone 55 | 698910 | 6092407 | 698936 | 6092450 | 50 | 0 | 5 | 0 | 5 | 2 | 6 | 5 | 30 | 0 | 73 |
| Woolshed Creek | ACT01 | 3 | WC_01.3.4 | MGA Zone 55 | 698419 | 6091828 | 698373 | 6091848 | 50 | 3 | 3 | 3 | 8 | 2 | 7 | 6 | 18 | 0 | 58 |
| Woolshed Creek | ACT01 | 4 | WC_01.4.1 | MGA Zone 55 | 698596 | 6092825 | 698596 | 6092775 | 50 | 0 | 3 | 0 | 0 | 0 | 26 | 19 | 0 | 3 | 6 |
| Woolshed Creek | ACT01 | 4 | WC_01.4.2 | MGA Zone 55 | 698254 | 6091706 | 698204 | 6091705 | 50 | 0 | 0 | 0 | 2 | 1 | 45 | 2 | 0 | 0 | 0 |
| Woolshed Creek | ACT01 | 4 | WC_01.4.3 | MGA Zone 55 | 698641 | 6092380 | 698629 | 6092322 | 50 | 0 | 0 | 0 | 6 | 0 | 36 | 7 | 1 | 0 | 2 |
| Woolshed Creek | ACT01 | 4 | WC_01.4.4 | MGA Zone 55 | 698749 | 6091811 | 698716 | 6091774 | 50 | 0 | 0 | 0 | 5 | 2 | 32 | 9 | 0 | 2 | 18 |
| Yass Valley Lot 2 | ACT01 | 1 | YV_01.1.1 | MGA Zone 55 | 682985 | 6104218 | 682938 | 6104242 | 50 | 0 | 0 | 1 | 11 | 0 | 1 | 8 | 26 | 3 | 76 |
| Yass Valley Lot 2 | ACT01 | 1 | YV_01.1.2 | MGA Zone 55 | 683229 | 6105157 | 683179 | 6105160 | 50 | 2 | 0 | 0 | 5 | 0 | 3 | 4 | 27 | 9 | 84 |
| Yass Valley Lot 2 | ACT01 | 1 | YV_01.1.3 | MGA Zone 55 | 684613 | 6105177 | 684571 | 6105150 | 50 | 7 | 2 | 6 | 1 | 0 | 0 | 1 | 30 | 3 | 97 |
| Yass Valley Lot 2 | ACT01 | 1 | YV_01.1.4 | MGA Zone 55 | 683838 | 6104736 | 683888 | 6104728 | 50 | 0 | 0 | 0 | 19 | 1 | 0 | 2 | 22 | 6 | 93 |
| Yass Valley Lot 2 | ACT01 | 3 | YV_01.3.1 | MGA Zone 55 | 682951 | 6104538 | 682973 | 6104493 | 50 | 0 | 0 | 0 | 9 | 0 | 12 | 2 | 26 | 1 | 66 |
| Yass Valley Lot 2 | ACT01 | 3 | YV_01.3.2 | MGA Zone 55 | 683007 | 6104710 | 683053 | 6104689 | 50 | 1 | 0 | 0 | 12 | 0 | 8 | 4 | 25 | 0 | 68 |
| Yass Valley Lot 2 | ACT01 | 3 | YV_01.3.3 | MGA Zone 55 | 683310 | 6105030 | 683358 | 6105015 | 50 | 0 | 1 | 0 | 9 | 0 | 16 | 5 | 23 | 0 | 52 |
| Yass Valley Lot 2 | ACT01 | 3 | YV_01.3.4 | MGA Zone 55 | 683796 | 6104732 | 683750 | 6104752 | 50 | 0 | 0 | 0 | 19 | 4 | 3 | 2 | 18 | 4 | 81 |
| Yass Valley Lot 2 | ACT01 | 4 | YV_01.4.1 | MGA Zone 55 | 683625 | 6104620 | 683606 | 6104573 | 50 | 0 | 0 | 0 | 13 | 0 | 34 | 0 | 0 | 3 | 8 |
| Yass Valley Lot 2 | ACT01 | 4 | YV_01.4.2 | MGA Zone 55 | 683339 | 6104896 | 683337 | 6104846 | 50 | 0 | 0 | 0 | 8 | 0 | 39 | 0 | 1 | 2 | 7 |
| Yass Valley Lot 2 | ACT01 | 4 | YV_01.4.3 | MGA Zone 55 | 683108 | 6104978 | 683157 | 6104982 | 50 | 0 | 1 | 0 | 6 | 0 | 38 | 2 | 2 | 1 | 7 |
| Yass Valley Lot 2 | ACT01 | 4 | YV_01.4.4 | MGA Zone 55 | 683418 | 6104428 | 683369 | 6104420 | 50 | 0 | 0 | 0 | 10 | 0 | 30 | 7 | 1 | 2 | 8 |

Appendix 3. PCS Excel Spreadsheets (excel files in separate .zip folder)

Appendix 4. GIS Data (shapefiles in separate .zip folder)