

**WEST BELCONNEN  
WOODLAND AREAS**

**CONFIRMATORY  
ECOLOGICAL ASSESSMENT**

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Report to The Riverview Group

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## 1. INTRODUCTION

This report has been prepared on behalf of The Riverview Group to address Task 1 and Task 2 in the *Draft for Discussion* paper distributed on 3 September 2012. The tasks generally relate to a review of the boundary of the White Box – Yellow Box – Blakely's Red Gum grassy woodlands and derived native grasslands (box – gum woodland) which has been previously identified within the southern part of the West Belconnen project area. Box – gum woodland is listed as a critically endangered ecological community under the Commonwealth *Environment Protection and Biodiversity Conservation Act (EPBC Act)*. It is understood that the report will be used to inform the process of determining the boundaries between a proposed nature reserve and urban development.

The West Belconnen project area encompasses West Molonglo, which is subject to strategic assessment under the *EPBC Act*. The *Molonglo Valley Plan for the Protection of Matters of Environmental Significance* (NES Plan, Ref. 1) establishes the ACT Government's commitments to avoid impacts on matters of national environmental significance within the strategic assessment area. Under the NES plan, in the event that West Molonglo is developed in the future then, subject to confirmatory ecological assessment, the area of box – gum woodland is required to be set aside for a nature reserve.

Studies undertaken by Eco Logical in late 2008 to early 2009 (Ref. 2) to inform the NES Plan identified approximately 64 ha of box – gum woodland within West Molonglo, of which about 7 ha was considered high value with the remaining considered medium value. Task 1 of the current study is to provide a confirmatory ecological assessment of that area.

Kevin Mills and Associates (Ref. 3) conducted an ecological study of the broader West Belconnen area in the latter part of 2008, on behalf of CB Richard Ellis. The study identified two areas of woodland within West Molonglo, and one area located to the south. While the two woodland areas within West Molonglo are broadly consistent in location with that identified by Eco Logical as box – gum woodland (Ref. 2), there are some differences in the alignment of the northern boundaries and in total area. The woodland to the south was outside the study area assessed by Eco Logical. Task 2 relates to a review of the extent of the southern patch of woodland and a clarification of its status under the *EPBC Act*. Figure 1.1 shows the location of the aforementioned woodland areas in the context of the southern part of the West Belconnen project area.

The differences in the results of the two previous studies reflect different survey methodology and seasonal conditions. The objective of the current study is to review the areas described above using current ACT Government methodology and in relation to the requirements of the *EPBC Act*.

The areas previously identified as box – gum woodland and/ or woodland, the land between the two areas and a limited area surrounding the sites, comprise the study area. The study area is bounded by Stockdill Drive to the south and a property boundary fence line to the north. The eastern boundary is generally delineated by fence lines but includes an adjoining part of the Strathnairn property. The western

boundary generally follows the tops of the steep slopes overlooking the Murrumbidgee River. The location of the study area is shown in Figure 1.1.

Prior to European settlement, the vegetation covering most of the study area is likely to have comprised grassy woodland dominated by yellow box (*Eucalyptus melliodora*) and Blakely's red gum (*E. blakelyi*). Patches of woodland dominated by snow gum (*E. pauciflora*) may have occurred in depressions and frost hollows, with shrubby woodland dominated by broad-leaved peppermints (*E. dives*) on south-facing slopes. Dry forest containing red stringybark (*E. macrorhyncha*) and scribbly gum (*E. rossii*) occurred on exposed dry, rocky sites on hill tops although would have had a limited distribution within the study area. The gullies most likely supported shrubby vegetation including blackthorn (*Bursaria spinosa*) and wattles (*Acacia* spp.).

Most of the original vegetation has since been modified through tree removal, cattle grazing, pasture improvement (fertiliser use, ploughing), removal of fallen debris, track construction and the provision of stock dams. These land uses have resulted in habitat simplification, a reduction in species diversity and the widespread establishment of introduced grasses and weeds. Cattle grazing has continued over the last 10 years within most of the study area but no further pasture improvement has occurred. Woody weeds have been progressively removed. Soil erosion control measures have been undertaken to control gully erosion, and fencing surrounds several eroded gully areas and dams to manage stock access. The density of the remnant eucalypts and the amount of regeneration varies considerably across the site.

The elevation within the study area ranges from approximately 535 to 615 metres ASL. The topography includes undulating terrain, generally sloping down from a high point in the south-eastern corner, westwards towards the Murrumbidgee River Corridor and northwards towards the ACT/ NSW border. There are three creek lines that generally flow from east to west. The banks of the creek located towards the northern boundary are densely vegetated in part, and the channel is narrow with relatively steep banks that are eroded in places. The creek flowing through the approximate centre of the site is less vegetated and more gently sloping towards the creek channel. The catchment area for the southernmost creek is a broad shallow valley where water flows are directed into two connected dams. All creeks flow intermittently only.

The ecological assessment is based primarily on information collected during site inspections undertaken in October, November and December 2012, but also includes information contained in earlier planning documents and assessment reports (Refs. 2 to 6). The boundary of the area assessed in the current report as box – gum woodland was inspected and confirmed by an advisor to the ACT Government Territory and Municipal Services Directorate (TAMS) on 20 December 2012. TAMS is tasked with the responsibility for the future management of the box – gum woodland within West Molonglo (Ref. 1).

No threatened plant species or potential habitat for threatened plant species have been found within the study area during previous targeted surveys, and such species are considered unlikely to be present (Ref. 2). Targeted searches for threatened

plants were not conducted as part of the surveys for the current report although any sightings of rare and threatened species were planned to be recorded as incidental observations.

The report also includes an assessment of the study area in relation to yellow box – red gum grassy woodland, listed as an endangered ecological community under the ACT *Nature Conservation Act (NC Act)*.

## 2. THREATENED WOODLAND COMMUNITIES

### 2.1 Woodland listed under the *EPBC Act*

White Box – Yellow Box – Blakely’s Red Gum grassy woodlands and derived native grasslands (box – gum woodland) is listed as a critically endangered ecological community under the Commonwealth *EPBC Act*. *White Box – Yellow Box – Blakely’s Red Gum grassy woodlands and derived native grasslands EPBC Act Policy Statement 3.5* (Ref. 7) provides guidelines to assist in the identification of this community.

In general, woodland patches are regarded as the threatened community only if they are greater than 0.1 ha and meet the following criteria:

- The dominance of, or prior dominance of, white box (*E. albens*), yellow box or Blakely’s red gum.
- A predominantly native ground layer, i.e. one where at least 50 percent of the perennial vegetation cover consists of native species.
- There are 12 or more non-grass understorey species present.
- If the diversity of non-grass species is less than 12 and the patch is 2 ha or greater in size,
  - the patch has an average of 20 or more trees per hectare; or
  - the density of mature trees is less than 20 trees per hectare and there is natural regeneration occurring.

A patch is described as a continuous area containing the ecological community and is the larger of:

- an area that contains five or more trees in which no tree is greater than 75 metres from another tree (it is assumed a tree is a mature tree); or
- the area over which the understorey is predominantly native.

The above description represents the lowest condition at which patches are included in the *EPBC Act* listed ecological community.

### 2.2 Woodland listed under the *ACT NC Act*

The *ACT Lowland Woodland Conservation Strategy* (Action Plan No. 27, Ref. 4) categorises woodland communities within the ACT according to the level of modification that has occurred within these communities since European settlement. The categories take into account species diversity, the extent of native cover in the groundlayer, the ability of the community to respond to assisted and natural regeneration and the presence of a soil seed bank that would provide a basis for regeneration. When describing the condition of woodlands, tree and ground layers are often considered separately as either layer may retain ecological integrity to some degree without the other, and the community be still regarded as woodland.

Woodland categories described in the action plan (Ref. 4) are:

- **partially modified lowland woodland**, which is relatively intact, contains a complete age range of trees and a range of understorey species not commonly found in more disturbed sites;
- **moderately modified lowland woodland**, which has been subject to land uses that have resulted in the loss of a significant component of the groundcover and have led to changes in species composition of the groundlayer;
- **moderately modified lowland woodland – secondary grassland**, which is a community that develops when the tree canopy of a woodland is removed, although the groundlayer remains relatively intact;
- **substantially modified lowland woodland**, where the vegetation is reduced to woodland trees over highly degraded native understorey with low species diversity. The component of exotic perennials and annual species is high.
- **severely modified lowland woodland**, which comprises woodland trees above a predominantly exotic groundlayer.

Woodland patches that are regarded as the endangered ecological community yellow box – red gum grassy woodland are those where:

- the existing (or former) canopy cover consists of at least 40 percent yellow box and/ or Blakely's red gum across the whole vegetation unit, irrespective of the tree density; and
- there is a species-rich native groundlayer and, although some introduced species may also be present, the understorey is not exotic pasture or degraded beyond recovery.

Although not specifically stated within ACT legislation, it is accepted that areas regarded as yellow box – red gum grassy woodland have a predominantly native groundlayer as described under the *EPBC Act*.

Under the guidelines provided in Action Plan No. 27 (Ref. 4), substantially modified and severely modified woodland are not classified as the threatened ecological community, as it is considered that they no longer contain the elements necessary to perpetuate the community through natural regeneration.

Based on the above descriptions, the ACT listed community can be considered a subset of the Commonwealth listed community. Areas that have high understorey diversity would be regarded as the threatened community under both the *NC Act* and the *EPBC Act*, but areas that have low understorey diversity would only be considered as the threatened community under the *EPBC Act*.

For the purposes of this report and unless otherwise stated, the two communities are considered to be the same entity and are referred to as box – gum woodland. The exception is in Chapter 4, which identifies patches of woodland separately under the two legislative instruments.

### 3. PREVIOUS STUDIES

Previous studies (Refs. 2 to 6) relating to the West Belconnen project area have identified areas of lowland woodland meeting criteria to be considered as an endangered woodland community under the *EPBC Act* and/ or the *NC Act*. The previous surveys differed in their assessment approach and were undertaken under different seasonal conditions. As a consequence, the areas considered as woodland, and in particular the *EPBC Act* listed woodland community, are somewhat disparate. The most relevant surveys are described below to provide a context for the current study and survey approach.

The ACT Government mapped areas of lowland woodland in various conditions across the ACT during the preparation of the *ACT Lowland Woodland Conservation Strategy* (Ref. 4). Woodland patches (polygons) were identified on air photos based on the uniformity of tree cover and polygons were then surveyed in the field between 1995 and 1999, with more detailed surveys undertaken in 2001 and 2002. A patch of moderately modified yellow-box – red gum grassy woodland was identified within the central part of the study area, adjoining the Strathnairn property. A patch described as partially modified woodland (not considered yellow-box – red gum grassy woodland) was located in the south of the current study area, and severely and substantially modified lowland woodland was found in the northern part (see Figure 3.1). At the time of the surveys for Action Plan No. 27, the understorey in the areas currently containing widely spaced or scattered eucalypts was found to be dominated by introduced pasture species.

Surveys by Kevin Mills and Associates conducted as part of a preliminary assessment of land within the West Belconnen project area (Ref. 3) were undertaken between late October and December 2008, i.e. spring to early summer. Data was collected from multiple traverses supplemented by seven 20 x 20 m quadrats to demonstrate variation in vegetation types. Vegetation communities were classified on the basis of their structure and the name(s) of the dominant species in the tallest stratum, using the structural classification system devised by Walker and Hopkins (Ref. 8). Four areas of woodland were identified including three patches located within the current study area (see Figure 1.1). The woodland patches within the current study area were described as:

- Community 1. Yellow Box *E. melliodora* - Blakely's Red Gum *E. blakelyi* woodland to open woodland, including secondary grassland on gentle topography; and
- Community 2. Peppermint - Stringybark Woodland (*E. dives* – *E. macrorhyncha* – *E. pauciflora* – *E. rossii*) on hilly terrain generally above Community 1.

The report notes that eucalypt species from both communities occurred together where the two communities overlapped.

Surveys to map the presence of box – gum woodland as described under the *EPBC Act* were conducted throughout December 2008 and February and March 2009 (summer to early autumn) by Eco Logical (Ref. 2) as part of the strategic assessment process for the development of Molonglo and North Weston.

Vegetation units were identified on the basis of mapping provided by the ACT Government which showed all the area south of the northernmost creek as moderately modified box – gum woodland and the woodland around and to the north of the creek as a separate ecological community. Mapping by the Conservation Council (Ref. 5) was also considered to guide survey effort. The survey methodology included aerial photograph interpretation and site reconnaissance, and traverse sampling was used to collect floristic and vegetation structural data. With relevance to the current study, a north-south transect approximately 500 metres in length was undertaken in approximately the centre of the area, while a separate traverse was located along the edges of the northernmost creek line. Eco Logical identified approximately 64 ha of box – gum woodland in three adjacent areas, as shown in Figure 1.1. The approach used, developed in consultation with the ACT Planning and Land Authority (ACTPLA) and the ACT Department of Territory and Municipal Services (TAMS), included the completion of standard proformas to collect data on flora species, vegetation structure and composition, and terrestrial and aquatic habitat features.

Further surveys by Eco Logical were undertaken in December 2009 to identify potential areas suitable as biodiversity offsets for the residual impacts to box – gum woodland of proposed urban development in Molonglo (Ref. 6). Data were collected from two additional transects located outside the western boundary of the study area. The results of the transects are not included in the Eco Logical report but there was no change from the area identified as box – gum woodland in their previous report.

The Eco Logical studies found that the condition of the *EPBC Act* listed box – gum woodland varied greatly across the survey area. Some patches contained a canopy of mature trees and/or a regenerating canopy, while others occurred as derived (or secondary) native grassland. The majority of the secondary grassland patches comprised native grasses with interspersed exotic grasses. Wooded examples were of an open structure, with limited woody debris on the ground, a high cover of grasses and forbs, and few shrubs. The northern creek line comprised the greatest floral diversity within the area surveyed, although snow gum woodland was identified as the dominant vegetation type in the lower parts of the creek.

The disparity in the mapping resulting from the various studies may highlight the changes in woodland condition that occur under varying seasonal conditions across time, particularly in ecological communities that have undergone significant disturbance and that are no longer intact. The different results may also reflect the application of a range of survey approaches. The only area to have been consistently identified as box – gum woodland in all three studies is the densely wooded patch adjoining the western boundary of the Strathnairn property.

## 4. WOODLAND ASSESSMENT

### 4.1 Introduction

The NES Plan requires that the area of box – gum woodland located within West Molonglo be subject to a confirmatory ecological assessment in order to establish the boundary of the area for reservation (Ref. 1). Because the West Belconnen project area extends to the south and west of West Molonglo and contains similar landscape features as well as areas previously assessed as box – gum woodland, there is potential for other areas to support the endangered community. Further assessment, based on methodology common to other more recent woodland assessments within the ACT, was identified as necessary to reconcile the differences between the previous studies and to identify more precisely the quality and boundary of any woodland that meets criteria for inclusion as an endangered ecological community under the *EPBC Act*.

The Conservation, Planning and Research Section (CPR) of the ACT Government has developed survey guidelines for determining lowland vegetation classification and condition in the ACT (Ref. 9) to promote consistency and reliability in vegetation surveys conducted within the ACT. These guidelines form the basis of the current survey approach. The survey guidelines have been revised since the previous surveys were undertaken and the revision provides further justification for a reassessment of the site.

### 4.2 Methodology

The vegetation within the study area was assessed using methodology based on the ACT survey guidelines (Ref. 9) but also incorporates guidelines outlined in *EPBC Act Policy Statement 3.5* (Ref. 7). The survey approach is outlined below.

- a. Undertake a meandering traverse across the woodland patches previously identified by Eco Logical and Kevin Mills and Associates, taking into account previous mapping for Action Plan No. 27. Examine areas outside those boundaries but within the study area. The objectives of the traverse were to:
  - identify the general boundaries of any discrete vegetation patches based on homogeneity of vegetation structure and composition;
  - classify the vegetation units according to the vegetation communities as described in Appendix B of the survey guidelines for determining lowland vegetation classification and condition in the ACT (Ref. 9); and
  - select locations for transects and quadrats to ensure appropriate coverage of areas previously assessed as box – gum woodland and any new areas of potential woodland as determined by the results of the traverse.

Step (a) was focussed on the identification the parts of the study area most likely to have once contained box – gum woodland. These areas were identified on the basis of the location of remnant yellow box, Blakely's red gum and, to some extent, red stringybark eucalypts and, where trees were absent, on the basis of topography,

aspect and elevation. According to *EPBC Act Policy Statement 3.5* (Ref. 7), areas outside that boundary would not meet criteria to be considered box – gum woodland.

b. Assess the condition of the understorey within each vegetation unit (patch) that has potential to be considered as box – gum woodland by analysing data collected using the following techniques:

- Traverse the area and record plant species observed, particularly targeting areas containing microhabitat features and those areas that appear least disturbed (rocky areas, fence lines, creek banks, patches isolated by fences, areas near fallen trees), as well as areas that have had topsoil removed recently but have become revegetated. These areas are most likely to support a wide range of native species. Record locations of any rare or threatened species listed in Appendix H and Appendix I of the guidelines (Ref. 9) if observed.
- Undertake step point assessments to determine the groundcover composition in each patch in terms of the percentage cover of native species, using a modified version of Appendix E in the survey guidelines (Ref. 9). Consistent with the guidelines, step point assessments were undertaken in areas that contained the typical vegetation cover within each patch. Groundcover vegetation is considered ‘native’ if native plants indigenous to the area comprise 50 percent or more of the perennial groundcover. The guidelines recommend 100 survey points per polygon, while NSW legislation (Ref. 10) requires 50 survey points per hectare up to a maximum of 500 points. Areas that have similar canopy cover but differ in groundcover composition were subdivided to ensure that all vegetation units were as homogenous in structure and composition as possible.

Although it is recommended in *EPBC Act Policy Statement 3.5* (Ref. 7) that step point counts are undertaken in late autumn (when annual cover is low), CPR considers that surveys that require determination of whether or not vegetation is native under the *NC Act* can be performed at any time of year (Ref. 9).

- Undertake 20 x 20 metre quadrat surveys in areas that represent the best condition of the vegetation type within each patch, recording all species observed and estimates of the percent cover of each species using a cover-abundance score based on a 7-point Braun-Blanquet scale. The results of the quadrat surveys were used to describe the condition or quality of each patch in terms of species diversity and floristic value.
- c. Identify the location of patches containing mature, regenerating and seedling eucalypts according to standard classification (i.e. natural regeneration are trees at least 15 cm circumference at 130 cm above the ground, mature trees have a circumference of at least 125 cm at 130 cm above the ground). In patches greater than 2 ha, the occurrence of mature and regenerating yellow box and/ or Blakely’s red gum trees is an indicator of potential box – gum woodland.

The surveys in the majority of the study area were undertaken on 8, 14 and 16 October 2012 with a review of the unit boundaries undertaken on 15 November. Further surveys west of the Murrumbidgee River corridor boundary, between the property boundary fence and the tops of the steep slopes overlooking the Murrumbidgee River, were undertaken on 11 December and 13 December. An onsite review and confirmation of the box – gum woodland boundary as assessed in the current report was undertaken in association with a representative from TAMS on 20 December 2012.

Total survey effort comprised about 33 person hours with the TAMS review taking an additional 4 person hours. The survey effort is considered appropriate in relation to the survey objectives.

Weather during the October surveys was fine and sunny, with light to moderate winds, and followed a two year period of relatively mild and wet conditions. The December surveys followed a localised two month period of generally dry and hot conditions. Rainfall in November was 66.8 mm, 29 mm of rain fell in November and no rain was recorded in December up to the time of the field surveys. The mean daytime temperature for October was 20.8°C, with temperatures in November and December reaching an average of 25.4°C and 26.2°C respectively. Weather observations were drawn from Canberra Airport {station 070351}.

The site is extensive and not all areas could be inspected in detail. Some cryptic or sparsely distributed species may not have been recorded. However, given the survey intensity and efforts to ensure all microhabitats, vegetation communities and condition classes were sampled, this limitation is not likely to affect the overall results and conclusions of the survey.

A total of 47 transect surveys and 7 quadrat surveys were undertaken. Quadrats were not undertaken during the December surveys as the changes in vegetation condition between October and November were too significant to provide comparative results. Transect surveys were undertaken in December although, to be consistent with the October surveys, plants that had desiccated in the intervening period but were still identifiable were considered as live species. In general, native grasses were clearly evident amongst the desiccated annual grasses, where they were present.

Species lists were compiled in October 2012 for the area east of the Murrumbidgee River corridor boundary and in December 2012 for the area west of the boundary. The most diverse parts of the study area identified in October were revisited in December prior to the additional surveys to confirm that native species previously identified were still evident. All of the native forbs and grasses remained identifiable through flowers or remnant seed heads, but a small number of native species were observed in greater abundance (*Glycine tabacina*, *Convolvulus angustissimus*), were flowering (*Rytidosperma* spp., *Austrostipa* spp.) and were therefore more evident, or were newly observed (*Chloris truncata*). Because of these differences and to maintain comparability of results, additional species observed in areas west of the fence are only reported where relevant to the objectives of the survey (i.e. where they affect the identification of areas supporting box – gum woodland).

Figure 4.1 shows the location of the transects and quadrats in relation to the areas previously assessed as woodland by Eco Logical (Ref. 2) and Kevin Mills and Associates (Ref. 3).

## 4.3 Results

### 4.3.1 Identification of vegetation units/ patches

Following the methodology outlined in points (a) and (b) described in Section 4.2, the study area was found to comprise the discrete vegetation units described below. Eleven vegetation units were identified, although two of the units occur as patches in disjunct locations. Units described on the same numerical basis, for example 1A, 1B and 1C meet the *EPBC Act* definition of a 'patch' but are described as separate units consistent with ACT survey methodology (Ref. 9). The locations of the units are shown in Figure 4.2. A list of plant species recorded in each unit is provided in Appendix A while photographs showing typical views are shown in Appendix B.

- Unit 1A.** Dominated by yellow box and/ or Blakely's red gum including mature trees, seedlings and significant eucalypt regeneration above an understorey dominated by native grasses and including more than 12 native forb species.
- Unit 1B.** Contains scattered mature yellow box and/ or Blakely's red gum and patches of dense eucalypt regeneration above an understorey dominated by introduced grasses, with a very limited diversity of native forb species. Although exotic perennial grasses generally dominate the understorey, there are large patches of native grasses, most commonly weeping grass (*Microlaena stipoides*).
- Unit 1C.** Contains scattered mature eucalypts that occur as isolated trees or in clusters, with some regeneration generally located near mature trees. Native grasses dominate the understorey although the proportion of annual species is high, and native forb species diversity is less than 12. Unit 1C includes an area surveyed in December, located west of the property boundary fence.
- Unit 2.** Contains scattered mature yellow box and/ or Blakely's red gum with variable eucalypt regeneration above an understorey dominated by native grasses and more than 12 native forb species. Unit 2 comprises small fragmented patches located on either side of the northernmost creek. Some of these areas may have bordered or were located within frost hollows. The boundary between former snow gum woodland and Unit 2 is particularly indistinct.
- Unit 3A.** Contains scattered mature yellow box and/ or Blakely's red gum with limited eucalypt regeneration above an understorey dominated by native grasses, but with few or less than 12 native forb species. The proportion of introduced pasture species is generally high, particularly that of annual grasses and clovers (*Trifolium* spp.). Transects within this area may be only marginally native dominant.

**Unit 3B.** Unit 3B is located on the western side of the study area adjoining Unit 3A. The unit contains sparsely scattered mature trees or secondary grassland where existing evidence suggests the original tree cover was dominated yellow box and/ or Blakely's red gum, and where the native grass component is dominant, if only marginally. There is limited regeneration of eucalypts. Native forb species diversity is less than 12 although, because of the number of rocky outcrops which provide some protection from grazing, the forb and native grass diversity is slightly higher than in Unit 3A. There are large areas dominated by perennial weeds such as St John's wort. Native grasses tend to have a more tussocky structure than found in Unit 3A.

**Unit 4.** Contains scattered to sparsely scattered mature yellow box and/ or Blakely's red gum or is secondary grassland. Unit 4 is generally characterised by limited eucalypt regeneration above an understorey dominated by introduced grasses with few native forb species. The forbs that were recorded are generally grazing tolerant species or are restricted to damp sites (reeds, sedges) or are found in isolated patches only. Large areas of exotic pasture dominated by annual grasses and a small eucalypt plantation lacking a native understorey are included in this unit.

The part of Unit 4 located west of the property boundary fence was assessed in December. A close inspection of the vegetation along the fence line was undertaken to determine whether or not Unit 3B extended beyond the fence. Although native grasses were found to occur in patches occasionally up to a metre west of the fence, the incidence of such patches was low and it was determined that the property fence formed an appropriate boundary between Unit 4 and Unit 3B.

Unit 4 is not designated in Figure 4.2 as it is comprised of residual patches of vegetation that do not meet other unit descriptions.

**Unit 5.** Dominated by trees not generally associated with box – gum woodland, i.e. broad-leaved peppermint, scribbly gum and/ or red stringybark. The understorey contains a mixture of native and introduced species, although the native content is generally low. Unit 5 includes a small hill that has been previously identified as within a larger patch of box – gum woodland with a diversity of more than 21 non-grass understorey species (by Ecological, Ref. 3). That patch is henceforth referred to as Unit 5A (see Figure 4.2).

**Unit 6.** Dominated by mature snow gums but also a mixture of other eucalypts, such as Blakely's red gum and broad leaved peppermint as regeneration. The area contains a diversity of native shrubs and forbs but also woody weeds. Unit 6 lies within an area subject to cold air drainage. It is a narrow band located on the banks of the northern creek and is limited in extent.

**Unit 7.** Contains dense shrubby riparian vegetation associated with a gully. There is a mixture of eucalypts generally occurring as regenerating saplings. The

area contains a diversity of native shrubs, most commonly blackthorn, but also woody weeds.

**Unit 8.** Contains planted Blakely's red gum and yellow box above an understorey dominated by native grasses and including more than 12 native forb species. Unit 8 has a high proportion of annual grasses and weeds that occur in large swaths amongst the more open areas dominated by native spear grass (*Austrostipa bigeniculata*). While more than 12 forbs were recorded, the forbs generally occur in isolated or localised patches. Unit 8 could be considered as partially restored box – gum woodland. The incidence of patches of native understorey diminishes significantly towards the edges of the plantation. Consequently, the Unit 8 boundary is smaller than the plantation area.

Unit 8 is outside the boundary of West Molonglo and therefore outside the area subject to strategic assessment under the *EPBC Act*.

It is important to note that the boundaries of the vegetation units as shown in the figures within the report are generally indistinct. Boundaries relating to more intact vegetation are less likely to change over time and, conversely, boundaries that define areas that have undergone significant disturbance or prolonged grazing are more likely to respond to seasonal conditions in the short term. Boundaries relating to fences are indicative of different management regimes across paddocks.

#### **4.3.2 Probable extent of original box – gum boundary**

The primary consideration for a woodland community to be regarded as box – gum woodland is the occurrence or former occurrence of Blakely's red gum and/ or yellow box as one of the most common overstorey species (Ref. 7).

The distribution of existing mature tree species in relation to topography, elevation and aspect suggests that, prior to European settlement, the dominant vegetation type covering the study area comprised box – gum woodland. The probable extent of the community within the study area is shown in Figure 4.3. In assessing the probable boundary of the woodland community, it was assumed that:

- mature yellow box and Blakely's red gum occurring together, or Blakely's red gum occurring alone or in the presence of other tree species, indicate box – gum woodland; and
- areas where species such as snow gum, red stringybark or broad-leaved peppermint are dominant indicate a different woodland community, even if the occasional yellow box is present.

It is probable that the original vegetation within and on the upper banks of the northernmost creek comprised a shrub-based complex, which intergraded with the surrounding box – gum woodland and pockets of snow gum woodland located in frost hollows. Box – gum woodland is not generally found in areas susceptible to cold air drainage (Ref. 4), and patches that have a continuous shrub layer (greater than 30 percent) are excluded from the listed community (Ref. 7). In terms of classification, the creek line vegetation is unlikely to have met the criteria for box –

gum woodland although would have been a functional component of the surrounding woodland community.

The original vegetation type in areas where broad-leaved peppermint is now dominant is difficult to determine with confidence as the species may occur in several communities, and the areas have undergone significant modification. For the purposes of the current survey, areas dominated by broad-leaved peppermint are not considered to be former box – gum woodland.

The assessment is subject to a measure of uncertainty because of the absence of mature trees in some parts of the area, and the tendency for different woodland communities to integrate across a diffuse boundary. The western boundary of the former woodland is particularly uncertain.

### 4.3.3 ACT vegetation communities

The following ACT vegetation communities were identified within the study area. The communities are as described in Appendix B of the survey guidelines for determining lowland vegetation classification and condition in the ACT (Ref. 9).

- Eucalyptus melliodora* – *Eucalyptus blakelyi* Tableland Grassy Woodland (yellow box – Blakely’s red gum tableland grassy woodland). This vegetation type is found on the middle and lower slopes of hills and in gently undulating topography that is less susceptible to cold air drainage. The community is described as occurring at an elevation range of 600 to 900 metres ASL (Ref. 9).

Yellow box – Blakely’s red gum tableland grassy woodland is dominant within the study area although occurs in a range of condition classes (see Section 2.2) and therefore not all areas meet the criteria to be regarded as the threatened woodland community. The woodland type is widespread on the undulating terrain, but also occurs in valleys. This community occurs in Units 1 to 4 and in Unit 8, at an elevation range of 540 to 600 metres ASL.
- Eucalyptus pauciflora* – *Eucalyptus rubida* Tableland Woodland (snow gum – candlebark tableland woodland) is found in frost hollows fringing natural grasslands at an elevation between 550 to 800 metres ASL (Ref. 9).

Within the study area, the community occurs in the area subject to cold air drainage along the northernmost creek (Unit 6) at an elevation about 550 metres ASL. Although not listed as threatened under the *EPBC Act*, snow gum – candlebark tableland woodland is considered to be an endangered woodland community under the *NSW Threatened Species Conservation Act* and is being considered for listing under the *NC Act*.
- Kunzea ericoides* Tableland Shrubland (burgan tableland shrubland) occurs in a range of landscape positions although often along riparian banks and rocky outcrops at an elevation range of 525 to 900 metres ASL (Ref. 9)

Within the study area, the shrubland community is found within the gullies and on creek banks in Unit 7. It also occurs on rocky outcrops within the adjoining

Murrumbidgee River corridor. The dominant species is blackthorn (*Bursaria spinosa*), listed as a characteristic species for this community.

- *Eucalyptus macrorhyncha* – *Eucalyptus rossii* Tableland Forest (red stringybark – scribbly gum tableland forest) occurs on dry sites and footslopes at an elevation up to 1000 metres ASL. The community includes broad-leaved peppermints (*E. dives*) (Ref. 9).

Within the study area, red stringybark – scribbly gum tableland forest has a limited distribution and is restricted to the south-eastern corner adjoining Stockdill Drive, above 610 metres ASL. The boundary of the forest community is not identified on any figure as it is not relevant in the context of the current study.

The identification of the existing vegetation communities as listed above is based on the ‘best fit’ between the observed dominant species compared with the characteristic species as listed in Appendix B of the survey guidelines (Ref. 9). In areas without trees, community classifications were extrapolated from nearby vegetation on similar topography, known ecological relationships and remnant indicator species. The classifications are dependent on the information provided in the guidelines, where it is acknowledged that some of the communities are not well surveyed or described. It is likely that the ACT vegetation community descriptions will be revised in the future.

The disturbed nature of much of the site and the loss of many vegetation community indicator species made the precise definition of original community boundaries difficult, particularly in areas dominated by broad-leaved peppermints (Unit 5). It is possible that those areas are derived from the *Eucalyptus dives* – *Eucalyptus bridgesiana* Tableland Woodland (broad-leaved peppermint – apple box tableland woodland) community, although the elevation of the site (560 to 615 m ASL) is lower than the range specified for this community in the ACT classification (i.e. 900 to 1200 m ASL). However, the vegetation corresponds to the Tablelands Dry Shrubby Box Woodland community described in the *ACT Lowland Woodland Conservation Strategy* (Ref. 4). The Strategy states that the community occurs on lower exposed but moister slopes where it intergrades with box – gum woodland and has a similar structure and understorey floristic composition.

In any event, the purpose of the surveys and classification is to identify potential areas of box – gum woodland and the patches dominated by broad-leaved peppermints are not part of the box – gum woodland ecological community.

In summary, while large parts of the study area have been substantially modified, the original natural vegetation is likely to have reflected the following broad patterns:

- *Kunzea ericoides* Tableland Shrubland within the major drainage lines, linking to the riparian communities along the Murrumbidgee River.
- *Eucalyptus melliodora* – *Eucalyptus blakelyi* Tableland Grassy Woodland on lower slopes, undulating saddles and low ridgelines, with deeper soils.
- *Eucalyptus pauciflora* – *Eucalyptus rubida* Tableland Woodland in frost hollows and south facing slopes affected by cold air drainage.

- *Eucalyptus dives* – *Eucalyptus bridgesiana* Tableland Woodland on south facing slopes, above box – gum woodland.
- *Eucalyptus macrorhyncha* – *Eucalyptus rossii* Tableland Forest in steep, rocky and dry sites with shallower soils, such as upper slopes and hill crests.

Only Units 1 to 4 and Unit 8 are located in former box – gum woodland and therefore only those units have the potential to meet the criteria for consideration as the threatened ecological community. Units 5, 6 and 7 do not have a dominance or former dominance of Blakely's red gum or yellow box. Although Unit 5A is in an area not considered to meet box – gum woodland criteria, the unit is considered in the following sections for confirmatory purposes.

#### 4.3.4 Condition of vegetation units

An analysis of the composition of each vegetation unit in terms of the following aspects provides the basis of an assessment of the overall condition of each unit:

- native groundcover;
- proportion of annual and perennial species;
- species richness;
- native species diversity and floristic value; and
- eucalypt regeneration and tree density.

#### Assessment of proportion of native groundcover

Step point transect surveys (Ref. 9) were used to determine the native component of the ground layer vegetation within units that have some potential to contain box – gum woodland (Units 1 to 4 and Unit 8), but also in Unit 5A. The surveys were undertaken in October 2012, i.e. mid spring, although Unit 8 and part of Unit 4 (west of the property boundary fence) were surveyed in early summer. Annual species, which ACT and EPBC Act guidelines suggest be excluded from the counts, form a relatively high proportion of the groundcover vegetation at this time. The timing of the survey allows for an assessment of overall groundcover condition, which may not be as apparent in winter when prolific annual species such as Paterson's curse (*Echium plantagineum*), pasture grasses and clovers are not evident. The high level of annual species growth may, however, obscure from view low growing native grasses such as wallaby grass which, although green during winter and spring, are easily smothered by annuals before they can put up a seed head in spring.

The overall recording rates for wallaby grasses in the current survey was low (<1 percent) but wallaby grasses were recorded as between 5 and 25 percent in the transect survey undertaken by Eco Logical (Ref. 3) and the species was identified as a 'typical' species by Kevin Mills and Associates (Ref. 2). The higher recording rate for native grasses in previous studies may be attributed to survey conditions in that they were undertaken at the end of an extended dry period which favours native species generally in the ACT. Remnants of the previous year's growth of summer growing native grasses such as redleg and kangaroo grass, however, as well species such as spear grasses and weeping grass that are green all year, were evident at the time of the survey. The timing of the survey is therefore considered appropriate.

A total of 4,317 sample points on 47 transects were assessedd. This represents a significant amount above that recommended by CPR (Ref. 9), i.e. at least 100 sample points per stratification unit (11 units would require 1,100 sample points). More than the recommended number of samples were assessed to improve the reliability of the data collected, and to provide reasonable evidence to support the conclusions of the study. Samples were taken at regular intervals across the study area in the relevant units and transects were fairly regularly spaced. Transect locations were selected to ensure adequate sampling of the typical vegetation cover within each patch, but also to ensure sufficient coverage of areas previously assessed as box – gum woodland by Eco Logical and as woodland by Kevin Mills and Associates (Refs. 2 and 3).

Table 4.1 presents a summary of the data relevant to Units 1 to 4, Unit 5a and Unit 8. The location of transects are shown in Figure 4.4 and full results are provided in Appendix C. Transects shown in Figure 4.4 are colour coded to reflect the individual transect results.

*Table 4.1* Summary of results of transect survey

UNIT	A. Number of samples	B. No. of samples with perennial vegetation	C. No. of samples with native vegetation	D. Non-native vegetation (perennial species)	E. Non-native vegetation (annual species)	F. Other (litter, rock, manure, bare ground)	G. Percentage cover of native vegetation
1A	625	400	279	121	172	53	70
1B	150	102	28	74	41	7	27
1C	370	191	127	64	153	26	66
2	200	146	81	65	49	5	55
3A	500	288	170	118	193	19	59
3B	400	200	122	78	183	17	61
4	1472	720	259	461	686	66	36
5A	100	51	19	32	47	2	37
8	300	146	95	51	139	15	65

The percentage cover of native groundcover vegetation within each unit is calculated as the number of samples with native vegetation (Column C) divided by the total number of samples with perennial vegetation (Column B, i.e. Column C plus Column D) and is shown in Column G (Ref. 10). The number of annual species (Column E) and other features (Column F) are omitted from these calculations. The number of samples collected from each unit (Column A) is generally a function of the relative size of the unit.

The results indicate that the groundcover vegetation would be considered as native in Units 1A (70%), 1C (66%), 2 (55%), 3A (59%), 3B (61%) and 8 (65%), but not in Units 1B (27%), 4 (36%) or 5A (37%).

### **Proportion of annual and perennial species**

A history of intensive grazing and fertiliser use (livestock dung and/ or chemicals) encourages the establishment of annual and perennial pasture grasses and weeds, which displace native species. As the annual species die and break down, they release nutrients into the soil, promoting further annual growth in the next season.

Elevated nutrient levels can persist in the soil, inhibiting the growth of native species (including trees) for many decades, even after grazing has ceased (Ref. 12). Exotic perennials have the potential to cause local extinction of many groundcover species.

The likelihood of recovering an area of woodland or secondary grassland with high residual nutrient levels, even with a significant input of resources, is low (Ref. 12). This issue is reflected in the *EPBC Act* listing criteria and the *NC Act* description of box – gum woodland, which suggest that woodland remnants that comprise isolated trees or clumps, or heavily degraded areas, do not meet criteria to be listed as the threatened ecological community.

Although not a determinant of the *EPBC Act* listing process, the transect results were analysed to assess the relative native/annual/perennial component of the vegetation to provide greater insight into the native quality of the woodland units. Table 4.2 presents a summary of these results.

*Table 4.2* Summary of results of transect survey as percentages by vegetation

UNIT	Number of samples with vegetation	Percentage native vegetation	Percentage introduced perennial vegetation	Percentage introduced annual vegetation
1A	572	49	21	30
1B	143	20	52	29
1C	344	37	19	44
2	195	42	33	25
3A	481	35	25	40
3B	383	32	20	48
4	1406	18	33	48
5A	98	19	33	48
8	285	33	18	49

Based on a reasonable (albeit arbitrary) assumption that a composition less than 25 percent of the total vegetation is a relatively low proportion, 30 to 40 percent is a moderate proportion, over 45 percent is relatively high while over 50 percent indicates dominance, the following general comments relating to the composition of the vegetation in each unit are applicable. The categories used have been devised for the purposes of this study only and may not be applicable in other circumstances.

- Unit 1A has a high to dominant proportion of native species but has a moderate component of introduced annual vegetation and a relatively low proportion of introduced perennial species.
- Unit 1B is dominated by introduced perennial species. It was observed during the transect survey that, while the low lying parts of the unit has a relatively high proportion of introduced perennial vegetation such as phalaris (*Phalaris aquatica*) and Yorkshire fog (*Holcus lanatus*), the elevated areas were dominated by weeping grass .
- Unit 1C has a high component of introduced annual species but has a low proportion of introduced perennial species and a moderate proportion of native species.

- Unit 2 has a moderate to high component of native species and a moderate component of introduced perennials. Annual species were lowest in this unit.
- Unit 3A has a moderate component of introduced annual species and native species, but the proportion of introduced perennial species is relatively low.
- Unit 3B has a high to dominant proportion of annual species but has a low proportion of introduced perennial species. The native component is moderate.
- Units 4 and 5A have a relatively high proportion of introduced annual species, a moderate component of introduced perennial species and a low component of native species.
- Unit 8 has a high component of introduced annual vegetation, a moderate component of native species and a low component of introduced perennial species.

The proportion of introduced perennial and annual species in all units suggests that residual soil nutrient levels are moderate to high across the area but are generally lowest in areas less favourable for stock grazing (Units 1A and 2) and higher in areas easily accessible to stock or in locations convenient for the property manager to house stock (Units 3A, 3B, parts of Units 4 and 5). Unit 1B has a relatively high proportion of introduced perennial vegetation as it contains lying and damp areas which provides favourable conditions for phalaris (*Phalaris aquatica*) and Yorkshire fog (*Holcus lanatus*). Unit 8 is located outside the cattle grazing property and has been subject to woodland recovery programs such as the reintroduction of trees. It is likely to have been less intensively grazed in recent years but has retained a high proportion of annual species.

This assessment is applicable at the time of the current survey and it is possible that the results would vary under different seasonal or annual conditions.

### **Assessment of species richness**

The number of native non-grass species present within a patch is a determining factor in the identification of box – gum woodland (see Chapter 2). A list of plants recorded in each unit under current survey conditions is provided in Appendix A.

Table 4.3 and Chart 4.1 show a comparison of the number of introduced perennial and annual species (grasses, weeds) and native species (grasses, forbs, shrubs) found within each vegetation unit. The results are a compilation of transect and quadrat data (see Appendix A), and refer to the number of species in each category. The species list for Unit 8 was compiled in December while the lists for the other units were compiled during the October surveys.

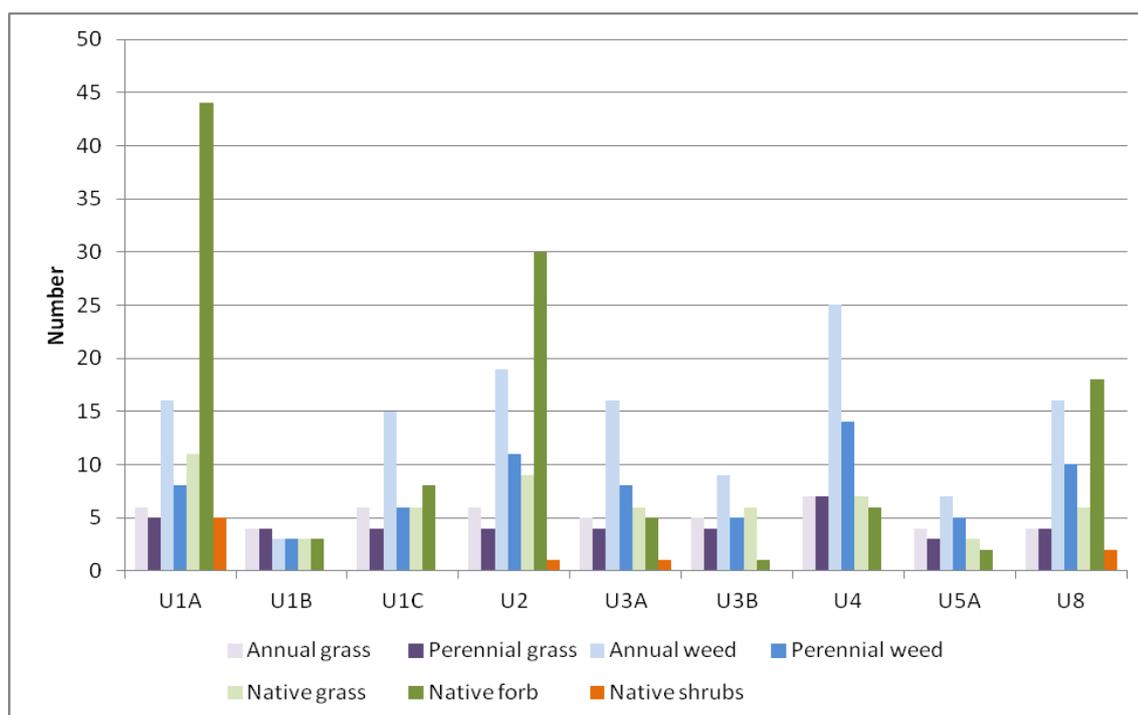
An analysis of data shows that Unit 1A has a significantly higher number of native forb (44) and shrub (5) species than the other units, although native forb richness in Unit 2 (30) is also relatively high while Unit 8 has moderate richness. Units 1A and 2 contain areas that are less accessible to stock and have therefore retained more of the original suite of native species. Unit 8 has been less regularly grazed.

Unit 4 covers a large area and is located across several topographical features and, as a result, has a relatively high number of annual (25) and perennial weeds (14). Units 5A and 1B have an overall low species richness, which can be attributed to the relatively small areas covered by these units, and the highly homogenous nature of the topographical location and aspect. Unit 3A provides favourable conditions for stock (flat ground, trees as shelter) and has subsequently been subject to higher grazing pressure than the contiguous area in Unit 3B. Consequently, Unit 3A has more annual weeds than Unit 3B. Otherwise, the number of introduced and native grass species is reasonably consistent across the site.

*Table 4.3* Species richness within units

Type/Unit	U1A	U1B	U1C	U2	U3A	U3B	U4	U5A	U8
Annual grass	6	4	6	6	5	5	7	4	4
Perennial grass	5	4	4	4	4	4	7	3	4
Annual weed	16	3	15	19	16	9	25	7	16
Perennial weed	8	3	6	11	8	5	14	5	10
<b>Total introduced</b>	<b>35</b>	<b>14</b>	<b>30</b>	<b>40</b>	<b>33</b>	<b>23</b>	<b>53</b>	<b>19</b>	<b>34</b>
Native grass	11	3	6	9	6	6	7	3	6
Native forb	44	3	8	30	5	1	6	2	18
Native shrubs	5	0	0	1	1	0	0	0	2
<b>Total native</b>	<b>60</b>	<b>6</b>	<b>14</b>	<b>40</b>	<b>12</b>	<b>7</b>	<b>13</b>	<b>5</b>	<b>26</b>

*Chart 4.1* Species richness within units



Surveys were conducted within Unit 1C (east of the property fence) in October 2012 and in Unit 1C (west of the fence) in December 2012. An additional five native forbs were found during the December survey, bringing the total number of forbs recorded

within Unit 1C to 13. The data collected in December, however, has not been used in the above statistical analysis to maintain data consistency.

No rare or threatened species as listed in Appendices H or I of *Survey guidelines for determining lowland vegetation classification and condition in the ACT* (Ref. 9) were observed within the study area during the current or previous surveys.

### Assessment of native diversity and floristic value

A comparison of the number of species in the most diverse quadrat in each unit provides a comparison of species diversity across those units. A list of plants recorded in each quadrat using a seven-point Braun-Blanquet score is provided in Appendix A. Photographs of each quadrat are provided in Appendix D. The quadrat diversity, i.e. the number of species per 400m<sup>2</sup>, is shown in Table 4.4

The floristic value of each quadrat relates to the type and abundance of native species present. Species that are common within the region or those that respond well to disturbance (eg. grazing, soil disturbance), or those that occur as 3 or fewer individuals only, do not contribute anything to the total expressed in the floristic value score. Conversely, species uncommon or rare within a region and recorded as more than 3 individuals, or those that do not persist when subject to a range of disturbance regimes, have greater significance and contribute more to floristic value. A site with high floristic values is more likely to reflect a site in its pre-European state and is considered to have greater significance in terms of its conservation value than a site with a low floristic value.

A floristic value score was derived using Appendix G in the CPR survey guidelines (Ref. 9). This quantitative method enables the assessment of the relative values of sites containing grassy ecosystems in the Southern Tablelands of NSW, according to the significance of the species found. Although this method was developed for grassy ecosystems in NSW and the species values applied were derived from the north-western sub-region, it is assumed that the general principles of the method would be valid also for grassy ecosystems of the ACT. While the methodology for calculating floristic values is under review, the results provided in Table 4.4 are based on current techniques.

Table 4.4 Diversity and floristic value

		Q2 (Unit 1A)	Q4 (Unit 1A)	Q3 (Unit 1C)	Q1 (Unit 2)	Q6 (Unit 3A)	Q7 (Unit 3B)
<b>Quadrat Diversity</b>	No. of non-grass species	21	21	8	13	8	7
	No. of grass species	5	3	3	4	3	3
<b>Floristic Value Score</b>		23	29	1	19	0	0

Note: Quadrat 5 data has been discounted in this assessment as the selection of the site was based on demonstrating abundance of native grasses rather than species diversity.

The results indicate that Quadrats 2 and 4 in Unit 1A have a relatively high diversity of native non-grass species (21 species each), Quadrat 1 in Unit 2 has moderate diversity (13 species) and Quadrat 6 in Unit 3A (8 species), Quadrat 3 (Unit 1C) and Quadrat 7 in Unit 3B (8 and 7 species respectively) have relatively low diversity (based on *EPBC Act* guidelines that 12 or more non-grass species represents a diverse groundlayer). All quadrats have similar diversity of native grasses.

Although the current methodology for floristic values does not classify the results, they can be used to discuss the relative values of sites within the woodland patches. Quadrats 2 and 4 have higher floristic values than Quadrats 6, 3 and 7, which have very low values. Although Quadrat 1 has moderate forb diversity and Q2 has higher diversity (a difference of 8) the floristic values are more similar (a difference of 4), indicating that the species present in Quadrat 1 have a higher degree of significance than those in Quadrat 2.

### **Assessment of eucalypt regeneration and tree density**

Measurements of mature tree density were derived from aerial photography and are indicative only. Mature eucalypts occur at a density of approximately 6 trees/ha in Unit 1, although the density is reduced to about 3 trees/ha in the southern part of the unit. The density in Unit 3A is about 5 trees/ha. Otherwise, tree density varies between 1 to 3 trees/ha across the more open woodland areas. In areas dominated by broad-leaved peppermint, the density is about 9 to 11 trees/ha, although many eucalypts occur as dead standing trees.

Tree density was not calculated in the plantation areas as few of the trees have reached a girth to be described as mature (i.e. a circumference of at least 125 cm at 130 cm above the ground). The density of trees is likely to exceed 20 trees per hectare should the existing trees survive to maturity.

Tree spacing in unmodified woodlands is not uniform but an average of 30 trees/ha is considered consistent with tree spacing in pre-European times (Ref. 12), and an average of 20 trees/ha is considered as a feature of significance in assessing woodlands in accordance with the *EPBC Act*. None of the units within the study area currently meets the average mature tree spacing of 20 trees/ha, reflecting a widespread and significant loss of canopy cover.

Tree composition in unmodified woodlands typically includes a relatively complete age range of trees (dead trees, large old trees with hollows, trees in middle stages of growth, saplings and seedling growth).

Eucalypt regeneration (saplings and seedlings) is common in protected or moist sites such as in valleys, in drainage areas, on creek banks, in fenced areas and in sites with westerly aspects. Patches of dense regeneration are widespread in Units 1A and 1B. The more open and heavily grazed areas (Units 3, 4 and 5) show limited regeneration although some seedlings and saplings are located in these units. Dieback of eucalypts is common across the area but is particularly high in areas dominated by broad-leaved peppermint and/or red stringybark, and in areas where the trees are widely spaced. The study area generally lacks trees in middle stages of growth.

Tree structural composition in Units 1A and 1B is more consistent with unmodified woodland than in other units although the density of regeneration is very high and may limit the growth of trees to maturity. High density regeneration may reduce understorey diversity (due to shading and competition for water) over the long term and would require appropriate management.

#### 4.4 Discussion

Table 4.5 provides a summary of the condition of the woodland patches in relation to the qualities discussed in Section 4.3.4. The results provide a basis for a discussion of relative conservation values. Features that are consistent with moderate to high quality woodland have been highlighted.

Table 4.5 Condition of woodland units

UNIT	Native (Table 4.1)	Proportion of introduced species (Table 4.2)		Native forb species richness (Table 4.3)	Relative Diversity / Floristic Value (Table 4.4)	Woodland structure (trees)	Overall condition and conservation value
		Perennial	Annual				
1A	Yes	Low	Moderate	High (44)	High/ High	Mixed age classes, dense regeneration with some more open areas	High
1B	No	High	Moderate	Very low (3)	Not considered	Scattered mature trees with some young trees, dense but patchy regeneration, low dieback	Moderate
1C	Yes	Low	Moderate - High	Low (8)	Low/ Very low	Low density mature trees, moderate dieback, moderate regeneration	Moderate
2	Yes	Moderate	Low - Moderate	High (30)	Moderate/ Moderate - High	Scattered mature trees, some regeneration	Moderate to high
3A	Yes	Low-Moderate	Moderate	Low (5)	Low/ Very low	Scattered mature trees, moderate dieback, very limited regeneration	Moderate to low
3B	Yes	Low	High	Very low (1)	Low/ Very low	Low density mature trees, moderate dieback, very limited regeneration	Moderate to low
4	No	Moderate	High	Low (6)	Not considered	Scattered mature trees with no trees in large areas, minimal regeneration,	Low
5A	No	Moderate	High	Very low (2)	Not considered	High dieback, limited regeneration	Low
8	Yes	Low	High	Moderate (18)	Not considered	Woodland trees have been planted at an appropriate density but are not yet mature	Moderate

Unit 1A is in the least modified condition of all the units as it contains more features consistent with the original woodland community. Unit 1A is therefore regarded as in moderate to high overall condition, and has the highest conservation value in terms of the criteria discussed. This finding is consistent with previous surveys in that Unit

1A has been identified as box – gum woodland in moderately modified condition (Refs. 2, 3 and 4).

The understorey in Unit 1B is highly degraded but the overall structure of the canopy layer is consistent with high quality woodlands. Unit 1B is contiguous with Unit 1A and is therefore considered to have moderate conservation value.

Unit 1C is contiguous to Unit 1A and has a native understorey with mature and regenerating eucalypts. The part of Unit 1C west of the property fence has few trees but is dominated by native grasses and contains some native forbs. Unit 1C has moderate conservation value.

Unit 2 contains high species richness with moderate to high relative floristic value, although is comprised of small fragmented patches. Unit 2 has moderate to high conservation value.

Units 3A and 3B are similar in woodland characteristics although the tree density in Unit 3B is lower than that in Unit 3A. These areas have undergone significant grazing pressure and occur in a highly modified state. The understorey contains low native diversity although groundcover meets criteria to be regarded as native. Unit 3 (3A and 3B) has low to moderate conservation value.

Units 4 and 5A are in a severely modified state and have low conservation value in terms of the criteria assessed in this study.

Unit 8 has a patchy understorey dominated by native grasses in localised areas and contains a moderate range of native forbs, although the forbs present are limited in distribution. The eucalypts that have been planted are appropriate to the site in terms of species and density. Unit 8 has moderate conservation value.

## 5. IDENTIFICATION OF BOX – GUM WOODLAND BOUNDARIES

### 5.1 General

The data from the surveys were analysed to identify areas that meet the:

- criteria for inclusion as an endangered ecological community under the *EPBC Act* and/ or
- criteria for inclusion as an endangered ecological community under the *ACT NC Act*.

### 5.2 Assessment under the *EPBC Act*

As previously stated (Section 2.1), the following criteria must be met for woodland to be classified as box – gum woodland under the *EPBC Act* (Ref. 7):

- The dominance of, or prior dominance of, white box (*E. albens*), yellow box or Blakely's red gum.
- A predominantly native ground layer, i.e. one where at least 50 percent of the perennial vegetation cover consists of native species.
- There are 12 or more non-grass understorey species present.
- If the diversity of non-grass species is less than 12 and the patch is 2 ha or greater in size,
  - the patch has an average of 20 or more trees per hectare; or,
  - if the density of mature trees is less than 20 trees per hectare, there is natural regeneration occurring.

The vegetation units identified in Section 4.3.1 have been assessed according to the *EPBC Act* guidelines. The results of this assessment are shown in Table 5.1 and Figure 5.1.

In accordance with the *EPBC Act* guidelines (Ref. 7), areas that can be reasonably considered contiguous in terms of groundcover and/ or canopy cover have been combined to form a single patch. Consequently, Units 1A, 1B and 1C are combined on the basis that the patch has a predominately native understorey and in recognition that a 'patch' can be extended to include trees not less than 75 metres distant from another tree. Although Unit 1B was not assessed as having a native understorey, there are large areas dominated by native grasses within the unit. Given that Unit 1B is adjacent to the relatively high quality Unit 1A and can be reasonably regarded as an extension of Unit 1A, it is feasible to consider Unit 1B as part of a contiguous patch. Unit 1C is considered part of the larger patch based on the proportion of native species within the understorey.

Unit 3A has been likewise combined with Unit 3B on the basis of the native quality of the understorey, and with Unit 2 on the basis of the proximity of mature trees and native understorey quality. The combination of Unit 3 and Unit 2 is reasonable despite the inclusion of parts of the creek line units (Unit 7) which is not box – gum woodland. Unit 6 has been included in its entirety because of its location with

respect to the box – gum woodland and in anticipation of its probable listing as an endangered ecological community under the *NC Act*.

Unit 4 has not been included in either patch because the understorey quality is too degraded and the area considered is large. A patch based on tree distance only is not reasonable in this case as the area in its entirety would no longer meet the requirement for predominantly native understorey composition, i.e. the perennial species would not be 50% native. Unit 4 is a separate unit, below the lowest condition at which patches are included in the *EPBC Act* listed ecological community.

Unit 5 does not meet the criteria for inclusion as box – gum woodland. The unit is not dominated by eucalypts generally associated with box – gum woodland. In particular, under current seasonal conditions, Unit 5A does not have a native understorey and has low species diversity.

Unit 8 is considered to be a discrete patch containing partially restored box – gum woodland. While Unit 8 is within the study area, however, it is not in the area considered under the NES Plan.

On the basis of the process described above, there are three patches within the study area that meet *EPBC Act* criteria for classification as the box – gum woodland ecological community. These patches are located in areas dominated or formerly dominated by Blakely's red gum and yellow box, and have a predominantly native groundcover overall.

An alternative interpretation of the guidelines within the *EPBC Act* would identify three moderate to large patches of box – gum woodland, with two smaller, fragmented patches located to the north of the northernmost creek. It is feasible to consider that Unit 6, which is dominated by snow gums because it is located in an area subject to cold air drainage, does not meet the criteria to be considered part of the endangered community. Unit 7 may not be considered box – gum woodland because of the dominant shrub layer. According to *EPBC Act Policy Statement 3.5* (Ref. 7), patches that have a continuous shrub layer (greater than 30 percent) are excluded from the listed community.

By adopting a precautionary approach, the first interpretation of the extent of the box – gum woodland community is considered to be more consistent with the guidelines and the listing advice for the community (Ref. 13) than the alternative more strict interpretation. The total area of box – gum woodland within the study area is therefore about 71 ha, of which 54 ha is located in the West Molonglo strategic assessment area, with 10 ha located to the west and about 7 ha to the south (see Figure 5.1).

Table 5.1 Summary assessment of vegetation units within the West Belconnen study area against the *EPBC Act* criteria

UNIT	CRITERION					
	Most common species is or was previously white box, yellow box or Blakely's red gum?	Predominantly native understorey?	0.1ha or greater in size?	12 of more native understorey species?	2ha or greater in size?	Average of 20 or more mature trees per ha? Or Natural regeneration of dominant overstorey eucalypts?
1A	Yes	Yes	Yes	Yes	Yes	Yes – regeneration
1B	Yes	Yes <sup>1</sup>	Yes	Yes <sup>1</sup>	Yes	Yes – regeneration
1C	Yes	Yes	Yes	Yes <sup>1</sup>	Yes	Yes – regeneration
2	Yes	Yes	Yes	Yes	Yes <sup>2</sup>	Yes – regeneration
3A	Yes	Yes	Yes	No	Yes	Yes – limited regeneration
3B	Yes	Yes	Yes	No	Yes	Yes – regeneration <sup>3</sup>
4	Yes	No	Yes	No	Yes	Yes – very limited regeneration
5	No	Not assessed	Yes	Possible	NA	Not yellow box and/ or Blakely's red gum
5A only	No	No	Yes	No	NA	Not yellow box and/ or
6	No	Not assessed	Yes	Possible	NA	Not yellow box and/ or Blakely's red gum
7	No	Not assessed	Yes	Possible	NA	Not yellow box and/ or Blakely's red gum
8	Yes	Yes	Yes	Yes	Yes	<b>Yellow box and Blakely's red gum have been reintroduced</b>

 Criterion leading to exclusion of the area as the listed community

- <sup>1</sup> Combined to form a contiguous patch with Unit 1A as per *EPBC Act* Guidelines (Ref. 7)  
<sup>2</sup> Yes if considered a single patch or if combined with Unit 3B as per *EPBC Act* Guidelines (Ref. 7).  
<sup>3</sup> Combined to form a contiguous patch with Unit 3A as per *EPBC Act* Guidelines (Ref. 7)

### 5.3 Assessment under the *NC Act*

As previously stated in Section 2.2, patches that meet the description to be assessed as yellow box – red gum grassy woodland are those that have (or once had) a high proportion of yellow box or Blakely's red gum in the canopy cover, and have a diverse array of native species within the understorey. The description includes areas that have been partially or moderately modified, but not those that have been substantially or severely modified to the extent that they remain as areas of woodland trees over a highly degraded understorey.

Units 1A and 2 retain sufficient woodland character and diversity to be considered as moderately modified yellow box – red gum grassy woodland. While the modified understorey in Unit 1B may place it towards the lower end of the hierarchy within the class of woodland in terms of botanical quality, the woodland is regenerating and is located adjacent to a highly diverse patch. It is feasible that, under appropriate management, the understorey quality of Unit 1B could be improved. The classification of Unit 1B as part of the yellow box – red gum grassy woodland community is consistent with the objectives of woodland conservation as outlined in Action Plan No. 27 (Ref. 4).

Unit 1C contains a variable groundcover with a moderate range of forbs observed during the October and December surveys. Two of the species (*Glycine tabacina*, *Triptilodiscus pygmaeus*) are considered as important species for the woodland community (Ref. 14), although none are considered disturbance sensitive (Ref. 4). It is feasible to consider that Unit 1C meets the criteria to be regarded as moderately modified lowland woodland – secondary grassland.

Although Action Plan No. 27 (Ref. 4) does not describe a specific category for restored woodland, the understorey within Unit 8 has retained sufficient forb diversity to be regarded as moderately modified lowland woodland – secondary grassland and, as such, Unit 8 meets the criteria to be considered as the threatened ecological community under the *NC Act*.

Units 3A, 3B and 4 no longer have a diverse understorey and would be considered as substantially or severely modified woodland. Units 5, 6 and 7 do not meet the criteria, based on the species composition of the existing trees.

The total area of yellow box – red gum grassy woodland within the study area is therefore about 42 ha, of which 25 ha is located in the West Molonglo strategic assessment area, with 10 ha located to the west and about 7 ha to the south.

## 6. CONCLUSIONS

The objectives of the report were to review the boundaries of the areas previously identified as box – gum woodland under both Commonwealth and ACT legislation, and to consider the area in relation to current ACT survey guidelines.

The interpretation of relevant guidelines presented in this report has identified approximately 71 ha of box – gum woodland as assessed under the *EPBC Act*, which includes approximately 42 ha of yellow box – red gum grassy woodland as described under the *NC Act*. The box – gum woodland within the study area occurs in three discrete patches (see Figure 5.1). The southern patch is considered box – gum woodland of high conservation value relative to the other parts of the study area.

About 54 ha of the box – gum woodland occurs within the strategic assessment area for West Molonglo. The boundaries of those areas have been confirmed during an inspection with a representative of TAMS.

The areas assessed as box – gum woodland in the present survey are broadly similar to that identified previously within West Molonglo. Under current seasonal conditions, however, the groundcover within the eastern part of the study area does not meet the criteria to be considered box – gum woodland.

The patch located in the south-eastern part of the study area identified as woodland by Kevin Mills and Associates was confirmed as dominated by broad-leaved peppermints. The site is described as partially modified lowland woodland in Action Plan No. 27 and would have been a functional component of the adjoining box – gum woodland community. The area has been subject to cattle grazing since the surveys for Action Plan No. 27 but remains in a moderately modified condition and has moderate to high ecological value.

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## FIGURES



## APPENDICES



## APPENDIX A. PLANT SPECIES LIST

SPECIES LIST			Q1	Q2	Q3	Q4	Q5	Q6	Q7		U1A	U1B	U1C	U2	U3A	U3B	U4	U5A	U8 <sup>1</sup>	
Scientific name	Common name																			
<b>Introduced grass</b>																				
* <i>Aira elegantissima</i>	hairgrass	A	2	2							x			x	x		x			
* <i>Avena</i> sp.	oats	A	1		2	1	1	2	1		x	x	x	x	x	x	x	x	x	x
* <i>Briza minor</i>	shivery grass	A	2	2	1						x		x	x			x			
* <i>Bromus hordeaceus</i>	soft brome	A	3		2								x			x	x			
* <i>Bromus</i> spp.	bromes	A	+		+		1	2	2		x	x	x	x	x	x	x	x	x	x
* <i>Dactylis glomerata</i>	cocksfoot	P															x			
* <i>Eleusine tristachya</i>	goose grass	P															x	x	x	
* <i>Eragrostis curvula</i>	African lovegrass	P						+			x		x		x		x			
* <i>Festuca arundinacea</i>	tall fescue	P												x						
* <i>Holcus lanatus</i>	Yorkshire fog	P									x	x	x	x		x	x			x
* <i>Hordeum</i> sp.	barley grass	A						2			x	x	x	x	x	x	x	x	x	x
* <i>Lolium</i> sp.	ryegrass	P	1					1			x	x		x	x	x	x	x	x	x
* <i>Nassella trichotoma</i>	serrated tussock	P																		
* <i>Paspalum dilatatum</i>	paspalum	P			+			+			x	x	x		x	x	x			
* <i>Phalaris</i> sp.	phalaris	P							+		x	x	x	x	x	x	x	x	x	x
* <i>Vulpia</i> spp.	squirrel tail/ rat's tail fescue	A	1	2	1			2	2		x	x	x	x	x	x	x	x	x	x
<b>Introduced forb</b>																				
* <i>Acetosella vulgaris</i>	sheep sorrel	P	2	1	1	1		2	2		x	x	x	x	x	x	x	x	x	x
* <i>Arctotheca calendula</i>	capeweed	A				+		+					x	x	x		x			
* <i>Capsella bursa-pastoris</i>	shepherd's purse	A						r							x		x			
* <i>Carthamus lanatus</i>	saffron thistle	A	r		+		+	1			x		x	x	x		x	x	x	
* <i>Centaureum erythraea</i>	common centaury	A		1		1					x		x	x			x			x
* <i>Cerastium glomeratum</i>	mouse-ear chickweed	A									x			x	x		x	x		
* <i>Chondrilla juncea</i>	skeleton weed	P															x			x
* <i>Cirsium vulgare</i>	spear thistle	A						+	+				x	x	x	x	x	x	x	x
* <i>Conyza</i> sp.	fleabane	A	1	+		1		+	1		x		x	x	x	x	x			x
* <i>Cyperus eragrostis</i>	umbrella sedge	P			+						x		x	x		x	x			x
* <i>Echium plantagineum</i>	Paterson's curse	A			+						x	x	x	x	x	x	x	x		
* <i>Echium vulgare</i>	viper's bugloss	A															x			x
* <i>Erodium cicutarium</i>	common stork's-bill	A					+				x			x	x		x			





## APPENDIX A. PLANT SPECIES LIST

SPECIES LIST		Q1	Q2	Q3	Q4	Q5	Q6	Q7	U1A	U1B	U1C	U2	U3A	U3B	U4	U5A	U8 <sup>1</sup>
<i>Haloragis heterophylla</i>	variable raspwort		+	1					x		x	x					
<i>Helichrysum luteoalbum</i>	jersey cudweed								x								
<i>Hydrocotyle laxiflora</i>	stinking pennywort				1				x								
<i>Hypericum gramineum</i>	small St John's wort		+		+				x								
<i>Juncus</i> spp.	rushes			+			+		x	x	x	x	x		x		x
<i>Leptorhynchos squamatus</i>	scaly buttons	1	2		1	r			x			x					
<i>Lomandra filiformis</i>	wattle matrush	1	r		1	r			x		x	x			x		x
<i>Lomandra multiflora</i>	many-flowered matrush								x								
<i>Luzula densiflora</i>	woodrush				+				x			x					
<i>Microtis</i> sp.	onion orchid	+	r		r				x			x					
<i>Oxalis perennans</i>	native oxalis				+	+			x			x					x
<i>Persicaria decipiens</i>	slender knotweed												x				
<i>Plantago varia</i>	variable plantain	+			+							x					
<i>Ranunculus lappaceus</i>	common buttercup											x					
<i>Rumex brownii</i>	swamp dock	+		+	+				x	x	x	x				x	x
<i>Schoenus apogon</i>	common bogssedge		+		1				x	x	#	x		x			x
<i>Senecio quadridentatus</i>	cotton fireweed		+		r				x								x
<i>Solenogyne dominii</i>	smooth solenogyne		+						x								
<i>Stackhousia monogyna</i>	creamy candles				r				x								
<i>Tricoryne elatior</i>	yellow rush lily		r						x			x					
<i>Triptilodiscus pygmaeus</i>	common sunray		2		+				x		x						
<i>Vittadinia cuneata</i>	fuzzweed								x			x					
<i>Vittadinia muelleri</i>	narrow-leaf New Holland daisy		1		+				x								x
<i>Wahlenbergia communis</i>	tufted bluebell								x								x
<i>Wahlenbergia gracilis</i>	Australian bluebell		r		1	+			x								
<i>Wurmbea dioica</i>	early Nancy		+		+				x			x					
<b>Native grass</b>																	
<i>Anthosachne scaber</i>	wheatgrass		+						x		#						x
<i>Aristida ramosa</i>	purple wiregrass		+						x			x	x		x		
<i>Austrostipa bigeniculata</i>	tall speargrass	1	+	1		4	2	2	x	x	x	x	x	x	x	x	x
<i>Austrostipa scabra</i>	corkscrew speargrass				2	1	1	1	x		x	x	x	x	x		x
<i>Bothriochloa macra</i>	redleg grass	2		1		2	+	1	x		x	x	x		x		x

## APPENDIX A. PLANT SPECIES LIST

SPECIES LIST		Q1	Q2	Q3	Q4	Q5	Q6	Q7		U1A	U1B	U1C	U2	U3A	U3B	U4	U5A	U8 <sup>1</sup>
<i>Microlaena stipoides</i>	weeping grass	1	1	3			1	2		x	x	x	x	x		x	x	x
<i>Panicum effusum</i>	hairy panic																	
<i>Poa labillardieri</i>	river tussock	+								x			x					
<i>Poa sieberiana</i>	snow grass		+							x								
<i>Rytidosperma</i> spp.	wallaby grasses	1	1			+	2	1		x	x	x	x	x	x	x		x
<i>Sporobolus creber</i>	slender rat's-tail grass			1						x			x			x		
<i>Themeda triandra</i>	kangaroo grass	2	3		2	2				x	x	x	x			x	x	
<b>Native shrub</b>																		
<i>Acacia dealbata</i>	silver wattle														x	x		
<i>Astroloma humifusum</i>	native cranberry				r					x								
<i>Bursaria spinosa</i> subsp. <i>lasiophylla</i>	blackthorn												x					x
<i>Cassinia longifolia</i>	shiny cassinia									x								x
<i>Clematis microphylla</i> var. <i>leptophylla</i>	small-leaf clematis									x								
<i>Hibbertia obtusifolia</i>	grey guinea flower									x								
<i>Leucopogon attenuatus</i>	grey beardheath				r					x								

**KEY**

A Introduced annual

P Introduced perennial

Native species are all perennial

<sup>1</sup> Species list for Unit 8 derived during December surveys

# Additional native species observed in the part of Unit 3C west of the boundary fence in December but not considered in further data analysis

**7-point Braun-Blanquet score**

r &lt;5% cover and solitary

+ &lt;5% cover and few

1 &lt;5% cover and numerous

2 5% – 25%

3 26% – 50%

4 50% – 75%

5 75+%



## APPENDIX B. TYPICAL VIEWS WITHIN UNITS

B/1



*Plate 1.* U1A Mature trees and regeneration above a predominantly native understorey (T31\*, 14 Oct).



*Plate 2.* U1A Southern part (T40\*, 14 Oct).



*Plate 3.* U1B Mature trees and regeneration above an understorey dominated by exotic grasses (T38\*, 14 Oct).



*Plate 4.* U1C Native understorey with scattered trees and some forbs present (T22\*, 14 Oct).

\* 'T1' refers to the step point transect number (see Figure 4.2). Transects are generally located in the centre of each photo.

## APPENDIX B. TYPICAL VIEWS WITHIN UNITS

B/2



*Plate 5.* U2 View from northern boundary across northernmost creek. U2 patch in foreground and to the left across creek (8 Oct).



*Plate 6.* U3A Marginally native to native understorey with scattered trees (T13\*, 8 Oct).



*Plate 7.* U3B Native understorey with high proportion of annuals and St John's wort (T10\*, 8 Oct).



*Plate 8.* U4 Scattered eucalypts above highly degraded understorey. View from below Unit 5A looking southwards (8 Oct).

\* 'T1' refers to the step point transect number (see Figure 4.2). Transects are generally located in the centre of each photo.

## APPENDIX B. TYPICAL VIEWS WITHIN UNITS



Plate 9. U5A Hill and south-west facing slope dominated by *E. dives* in poor condition (8 Oct).



Plate 10. U5 Valley dominated by *E. dives* in south-eastern part of study area (15 Oct).



Plate 11. U6 View towards part of northernmost creek containing *E. pauciflora* (8 Oct).



Plate 12. U7 View towards shrub dominated creek in the northern part of the study area (T1\*, 8 Oct).

\* 'T1' refers to the step point transect number (see Figure 4.2). Transects are generally located in the centre of each photo.

## APPENDIX B. TYPICAL VIEWS WITHIN UNITS



*Plate 13.* U8 View across area where eucalypts have been planted. Understorey is highly variable (T43\*, 11 Dec).



*Plate 14.* U4 Exotic grass dominated area between U1A (left) and U3A (right) (T18\*, 14 Oct).



*Plate 15.* U3C Fence line between parts of U3C (on the hill) assessed in Oct (left) and Dec (right) (11 Dec).



*Plate 16.* Fence line between Unit 3B (left) and Unit 4 (right) showing effects of varying management regimes (8 Oct).

\* 'T1' refers to the step point transect number (see Figure 4.2). Transects are generally located in the centre of each photo.

## APPENDIX C. TRANSECT RESULTS

Type/ Transect no.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
cow pat 0	0	0	1	0	0	0	1	1	0	2	1	2	3	0	3	1	2	3	0	3
eucalypt sapling 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
bare ground 2	1	0	1	0	0	1	3	1	1	0	0	0	2	1	2	2	3	0	3	2
rock 3	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	2	0	0	0
litter, dead plant 4	0	2	0	1	0	1	2	4	0	6	2	0	0	1	1	1	3	5	2	4
introduced annual grass 5	15	12	8	10	18	18	18	39	7	49	48	34	19	14	5	16	22	20	28	14
introduced annual weed 6	8	11	9	18	9	13	16	19	2	24	20	24	24	13	15	23	16	13	14	20
introduced perennial grass 7	16	6	13	18	1	3	2	9	2	4	5	6	6	6	14	15	8	18	2	0
introduced perennial weed 8	32	17	17	40	9	4	42	20	10	20	28	14	19	7	3	8	12	51	19	5
native grass 9	27	15	25	21	11	10	59	54	20	45	42	20	27	8	6	14	11	38	31	2
native forb (perennial) 10	1	10	3	4	2	0	7	3	8	0	3	0	0	0	1	0	1	2	1	0
No. of samples	100	73	77	112	50	50	150	150	50	150	150	100	100	50	50	80	80	150	100	50
<b>Total Annual (5+6)</b>	23	23	17	28	27	31	34	58	9	73	68	58	43	27	20	39	38	33	42	34
<b>Total Perennial (7+8)</b>	48	23	30	58	10	7	44	29	12	24	33	20	25	13	17	23	20	69	21	5
<b>Total Native (9+10)</b>	28	25	28	25	13	10	66	57	28	45	45	20	27	8	7	14	12	40	32	2
<b>Total Other (0 – 4)</b>	1	2	2	1	0	2	6	6	1	8	4	2	5	2	6	4	10	8	5	9
<b>% of perennial vegetation that is native</b>	37	52	48	30	57	59	60	66	70	65	58	50	52	38	29	38	38	37	60	29
<b>RESULT*</b>	<b>E</b>	<b>M</b>	<b>M</b>	<b>E</b>	<b>NHA</b>	<b>NHA</b>	<b>N</b>	<b>N</b>	<b>N</b>	<b>NHA</b>	<b>NHA</b>	<b>MHA</b>	<b>M</b>	<b>E</b>	<b>E</b>	<b>E</b>	<b>E</b>	<b>E</b>	<b>N</b>	<b>E</b>
<b>Vegetation only</b>																				
<b>% native</b>	28	35	37	23	26	21	46	40	57	32	31	20	28	17	16	18	17	28	34	5
<b>% annual introduced</b>	23	32	23	25	54	65	24	40	18	51	47	59	45	56	45	51	54	23	44	83
<b>% perennial introduced</b>	48	32	40	52	20	15	31	20	24	17	23	20	26	27	39	30	29	49	22	12

\* RESULT: N – native      NHA – native, high % annual      M – marginal (native is 45-55%)      MHA – marginal, high% annual      E - exotic

## APPENDIX C. TRANSECT RESULTS

Type/ Transect no.	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
cow pat 0	3	0	2	1	0	0	1	1	1	0	1	3	5	0	1	2	0	1	1	3
eucalypt sapling 1	0	0	0	0	0	0	0	0	0	0	4	1	0	0	0	0	0	0	0	0
bare ground 2	4	0	0	2	5	0	3	2	0	0	2	1	2	1	2	0	0	1	0	0
rock 3	0	0	0	0	2	0	0	0	1	0	0	1	1	0	0	0	0	0	0	1
litter, dead plant 4	4	8	3	3	2	0	0	1	5	1	13	3	1	0	2	0	3	4	0	3
introduced annual grass 5	38	20	25	25	10	2	16	20	24	14	29	12	14	19	36	12	13	12	21	21
introduced annual weed 6	18	18	12	19	12	0	15	19	6	1	10	15	12	7	21	8	6	5	3	16
introduced perennial grass 7	0	6	1	1	13	7	0	19	0	0	4	2	4	3	11	16	8	15	43	2
introduced perennial weed 8	7	13	29	28	14	12	9	17	17	12	8	18	7	17	14	6	10	8	8	12
native grass 9	23	33	27	21	14	24	6	19	46	22	64	40	4	3	13	5	10	4	23	40
native forb (perennial) 10	3	2	1	0	3	5	0	2	0	0	15	4	0	0	0	1	0	0	1	2
No. of samples	100	100	100	100	75	50	50	100	100	50	150	100	50	50	100	50	50	50	100	100
<b>Total Annual (5+6)</b>	56	38	37	44	22	2	31	39	30	15	39	27	26	26	57	20	19	17	24	37
<b>Total Perennial (7+8)</b>	7	19	30	29	27	19	9	36	17	12	12	20	11	20	25	22	18	23	51	14
<b>Total Native (9+10)</b>	26	35	28	21	17	29	6	21	46	22	79	44	4	3	13	6	10	4	24	42
<b>Total Other (0 – 4)</b>	11	8	5	6	9	0	4	4	7	1	20	9	9	1	5	2	3	6	1	7
<b>% of perennial vegetation that is native</b>	79	65	48	42	39	60	40	37	73	65	87	69	27	13	34	21	36	15	32	75
<b>RESULT*</b>	<b>NHA</b>	<b>N</b>	<b>M</b>	<b>E</b>	<b>E</b>	<b>N</b>	<b>E</b>	<b>E</b>	<b>N</b>	<b>N</b>	<b>N</b>	<b>N</b>	<b>E</b>	<b>N</b>						
<b>Vegetation only</b>																				
<b>% native</b>	29	38	29	22	26	58	13	22	49	45	61	48	10	6	14	13	21	9	24	45
<b>% annual introduced</b>	63	41	39	47	33	4	67	41	32	31	30	30	63	53	60	42	40	39	24	40
<b>% perennial introduced</b>	8	21	32	31	41	38	20	38	18	24	9	22	27	41	26	46	38	52	52	15

\* RESULT: N – native    NHA – native, high % annual    M – marginal (native is 45-55%)    MHA – marginal, high% annual    E - exotic

## APPENDIX C. TRANSECT RESULTS

Type/ Transect no.	41	42	43	44	45	46	47
cow pat 0	0	0	0	1	0	0	3
eucalypt sapling 1	0	0	0	0	0	0	0
bare ground 2	0	1	1	0	0	0	0
rock 3	0	1	0	0	0	0	2
litter, dead plant 4	0	5	7	0	0	0	2
introduced annual grass 5	64	59	23	44	31	27	52
introduced annual weed 6	27	15	42	18	10	10	7
introduced perennial grass 7	10	9	2	2	3	6	3
introduced perennial weed 8	30	22	18	22	3	2	35
native grass 9	17	33	54	8	2	5	65
native forb (perennial) 10	2	5	3	5	1	0	1
No. of samples	150	150	150	100	50	50	170
<b>Total Annual (5+6)</b>	91	74	65	62	41	37	59
<b>Total Perennial (7+8)</b>	40	31	20	24	6	8	38
<b>Total Native (9+10)</b>	19	38	57	13	3	5	66
<b>Total Other (0 – 4)</b>	0	7	8	1	0	0	7
<b>% of perennial vegetation that is native</b>	32	55	74	35	33	38	63
<b>RESULT*</b>	<b>E</b>	<b>MHA</b>	<b>N</b>	<b>E</b>	<b>E</b>	<b>E</b>	<b>N</b>
<b>Vegetation only</b>							
<b>% native</b>	13	37	40	13	6	10	40
<b>% annual introduced</b>	61	52	46	63	82	74	36
<b>% perennial introduced</b>	27	22	14	24	12	16	23

\* RESULT: N – native      NHA – native, high % annual      M – marginal (native is 45-55%)      MHA – marginal, high% annual      E - exotic



**APPENDIX D. QUADRAT PHOTOGRAPHS**



*Plate 1. Q1 (U2) From southern boundary looking west.*



*Plate 2. Q2 (U1A) From southern boundary looking north-west.*



*Plate 3. Q3 (U1C) From northern boundary looking south-east.*



*Plate 4. Q4 (U1A) Looking south-west. Quadrat undefined but based around rocky outcrops only.*

**APPENDIX D. QUADRAT PHOTOGRAPHS**



*Plate 5. Q5 (U1A) From southern boundary looking north.*



*Plate 6. Q6 (U3A) Looking south-east.*



*Plate 7. Q7(U3B) From northern boundary looking south-east.*

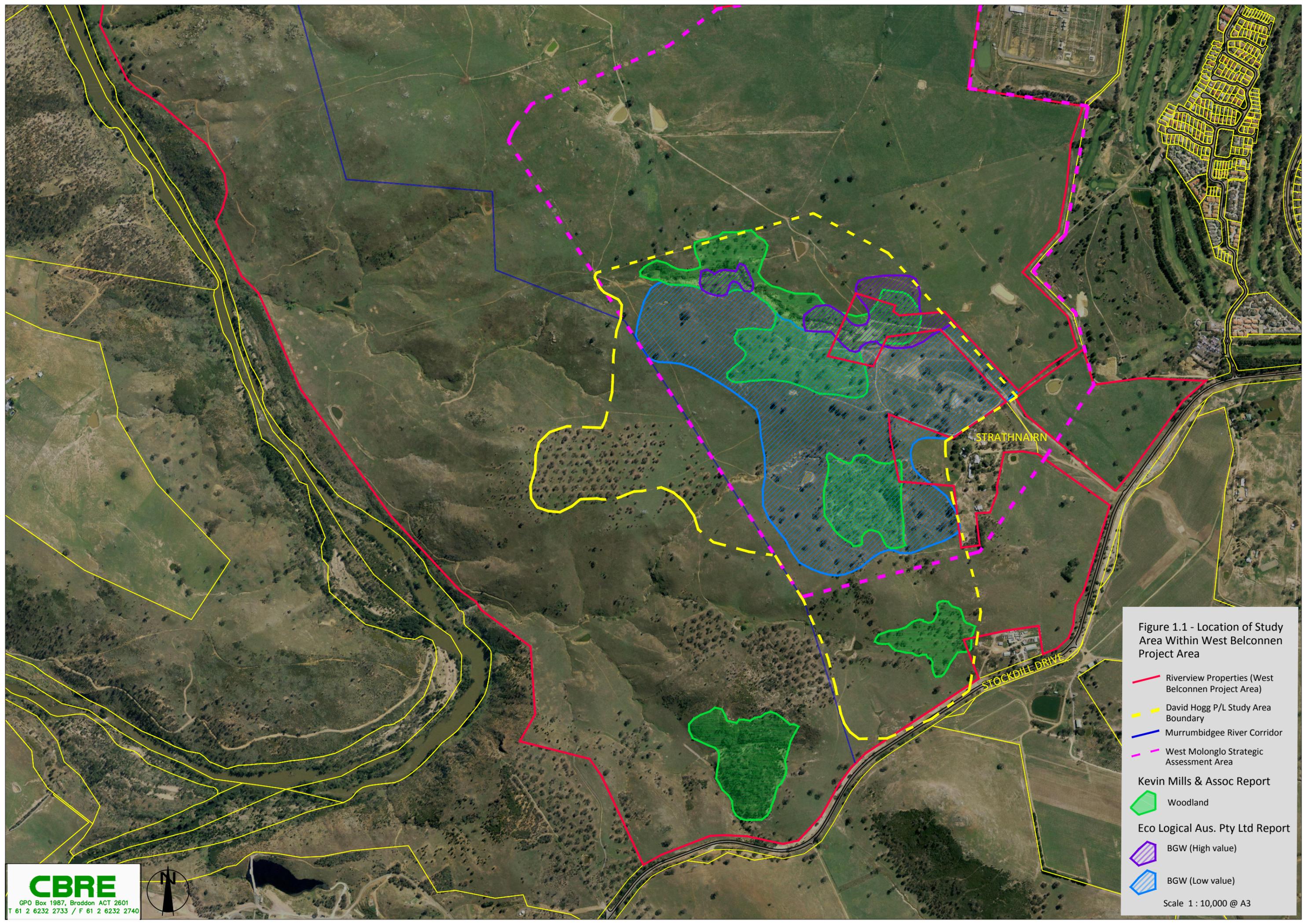


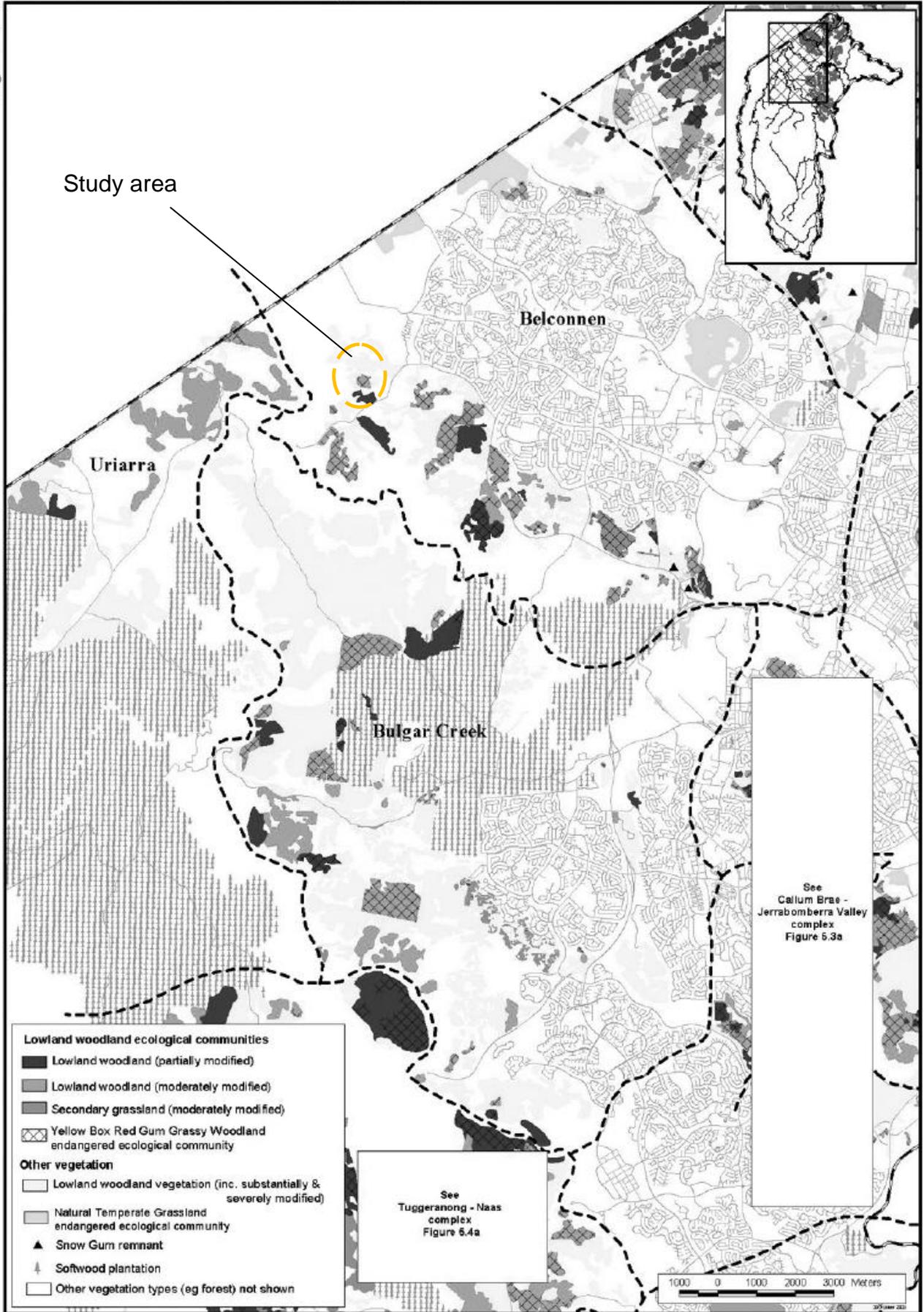
Figure 1.1 - Location of Study Area Within West Belconnen Project Area

- Riverview Properties (West Belconnen Project Area)
- - - David Hogg P/L Study Area Boundary
- Murrumbidgee River Corridor
- - - West Molonglo Strategic Assessment Area
- Kevin Mills & Assoc Report**
- ▭ Woodland
- Eco Logical Aus. Pty Ltd Report**
- ▨ BGW (High value)
- ▨ BGW (Low value)
- Scale 1 : 10,000 @ A3



North Murrumbidgee - Lower Molonglo complex

Figure 5.5a



Source: Action Plan No. 27 (Ref. 4)

Figure 3.1 Woodland in Lower Molonglo

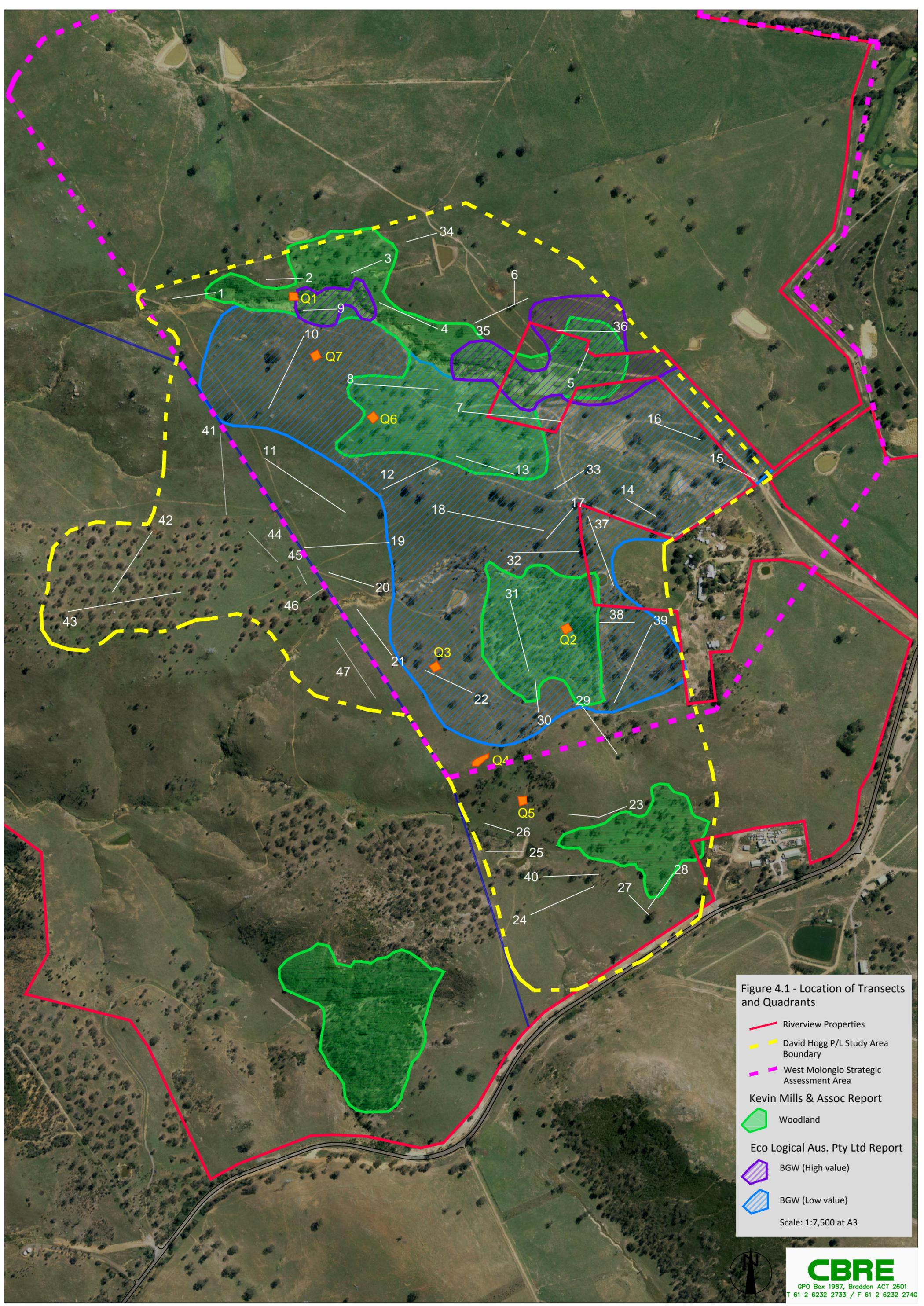


Figure 4.1 - Location of Transects and Quadrants

- Riverview Properties
  - - - David Hogg P/L Study Area Boundary
  - - - West Molonglo Strategic Assessment Area
  - Kevin Mills & Assoc Report**
  - ▭ Woodland
  - Eco Logical Aus. Pty Ltd Report**
  - ▨ BGW (High value)
  - ▨ BGW (Low value)
- Scale: 1:7,500 at A3

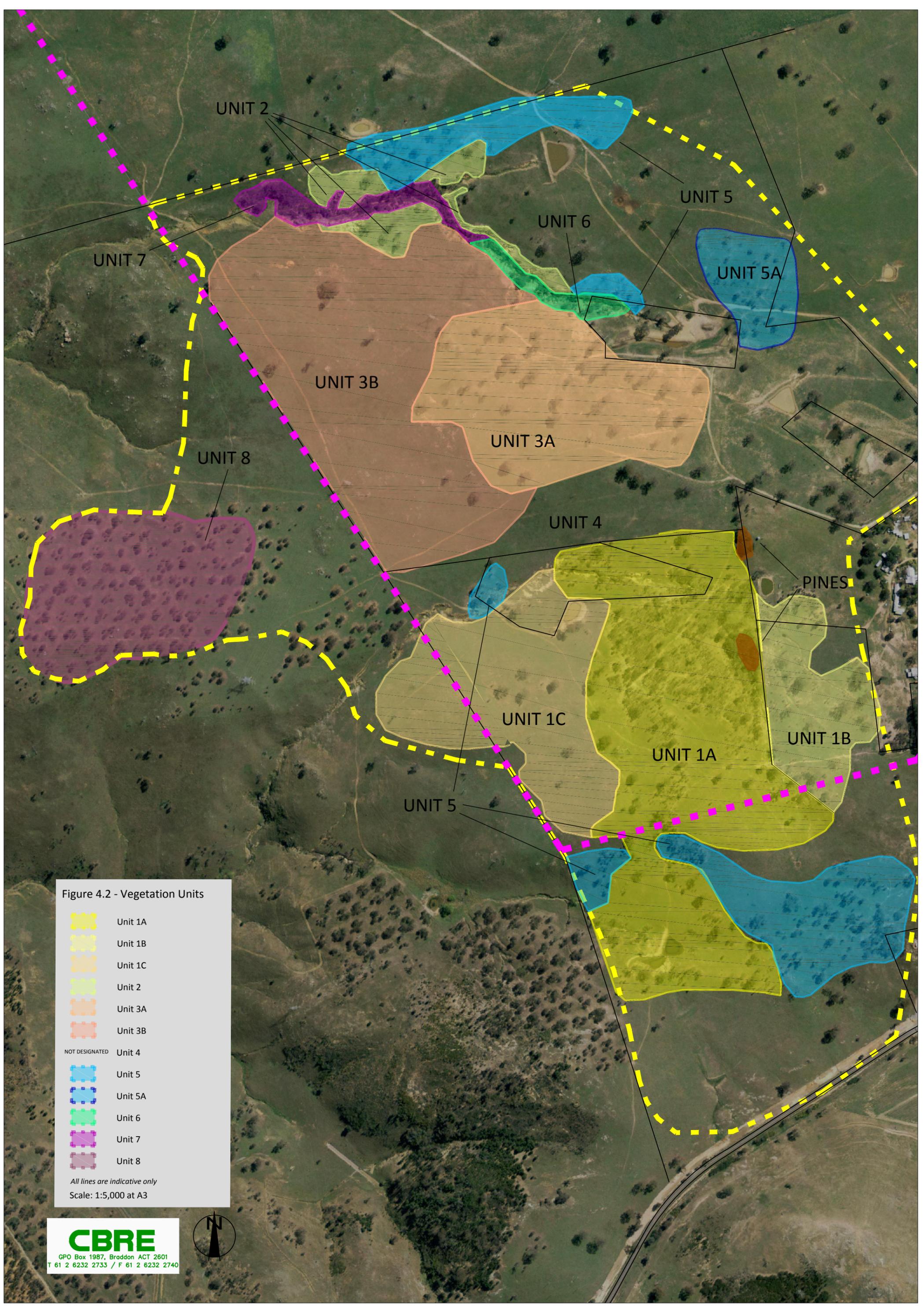


Figure 4.2 - Vegetation Units

-  Unit 1A
-  Unit 1B
-  Unit 1C
-  Unit 2
-  Unit 3A
-  Unit 3B
- NOT DESIGNATED Unit 4
-  Unit 5
-  Unit 5A
-  Unit 6
-  Unit 7
-  Unit 8

All lines are indicative only  
Scale: 1:5,000 at A3



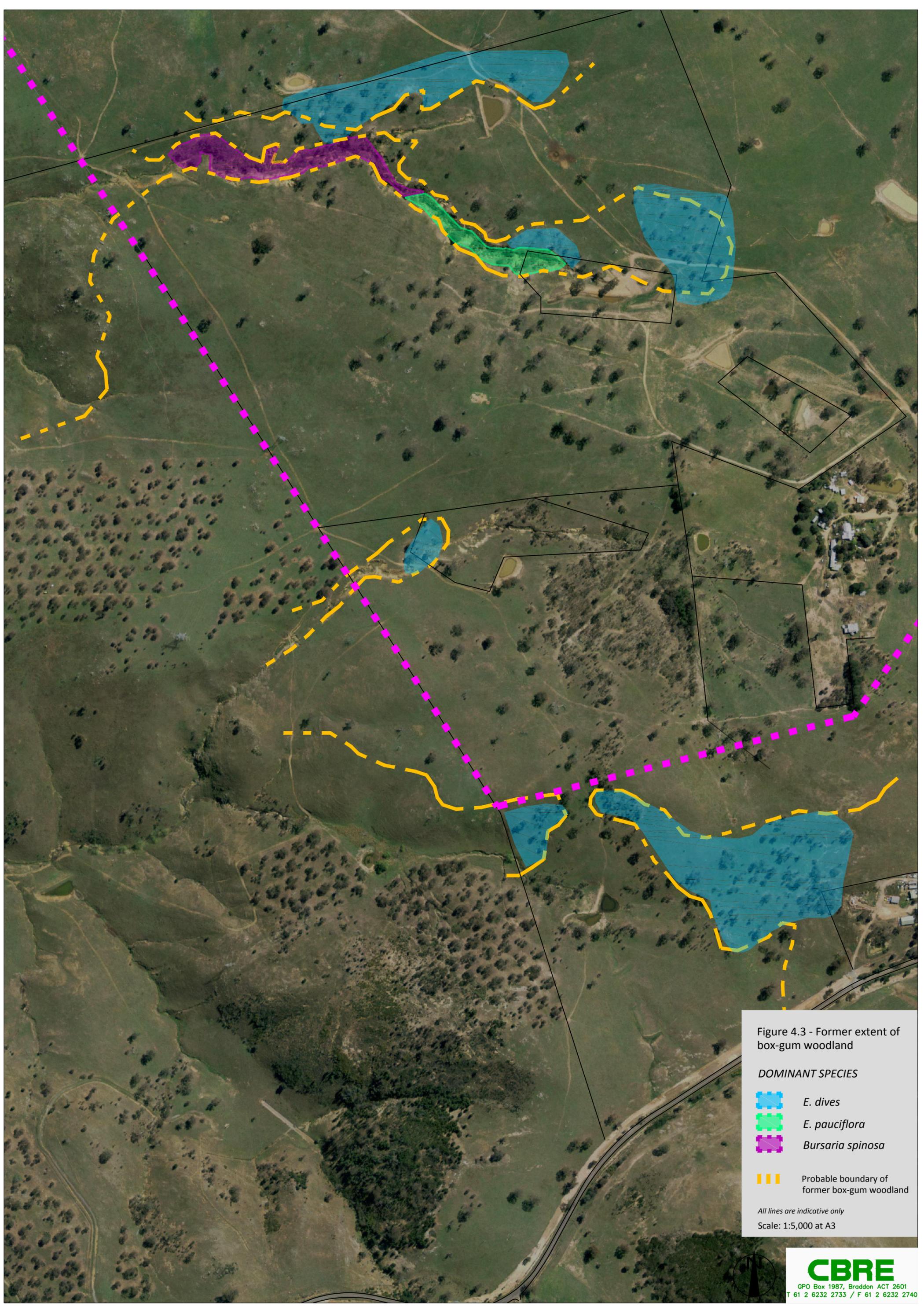


Figure 4.3 - Former extent of box-gum woodland

**DOMINANT SPECIES**

-  *E. dives*
-  *E. pauciflora*
-  *Bursaria spinosa*

 Probable boundary of former box-gum woodland

All lines are indicative only

Scale: 1:5,000 at A3

Although not quantitatively assessed, groundcover vegetation observed to be dominated by introduced grasses.

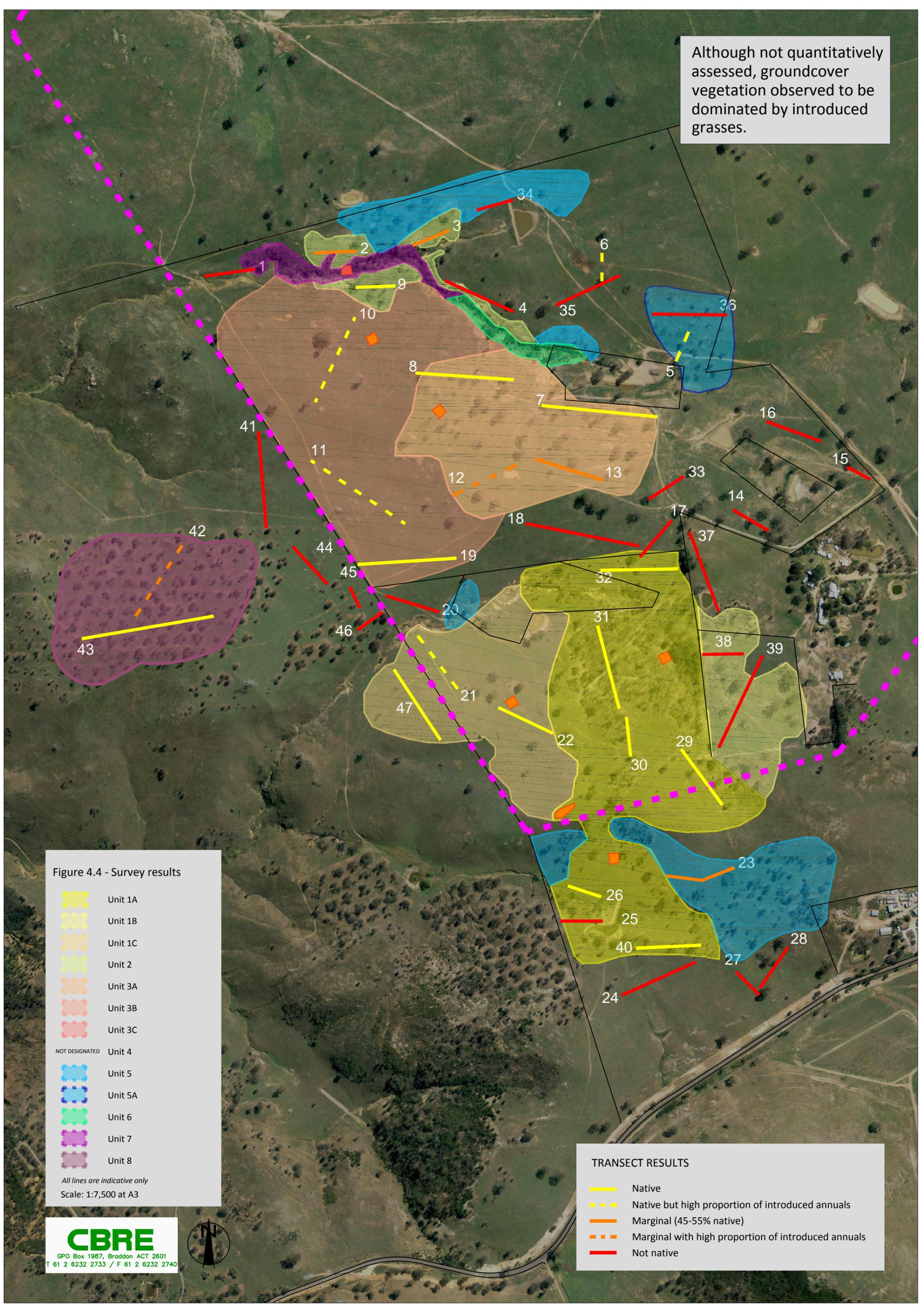


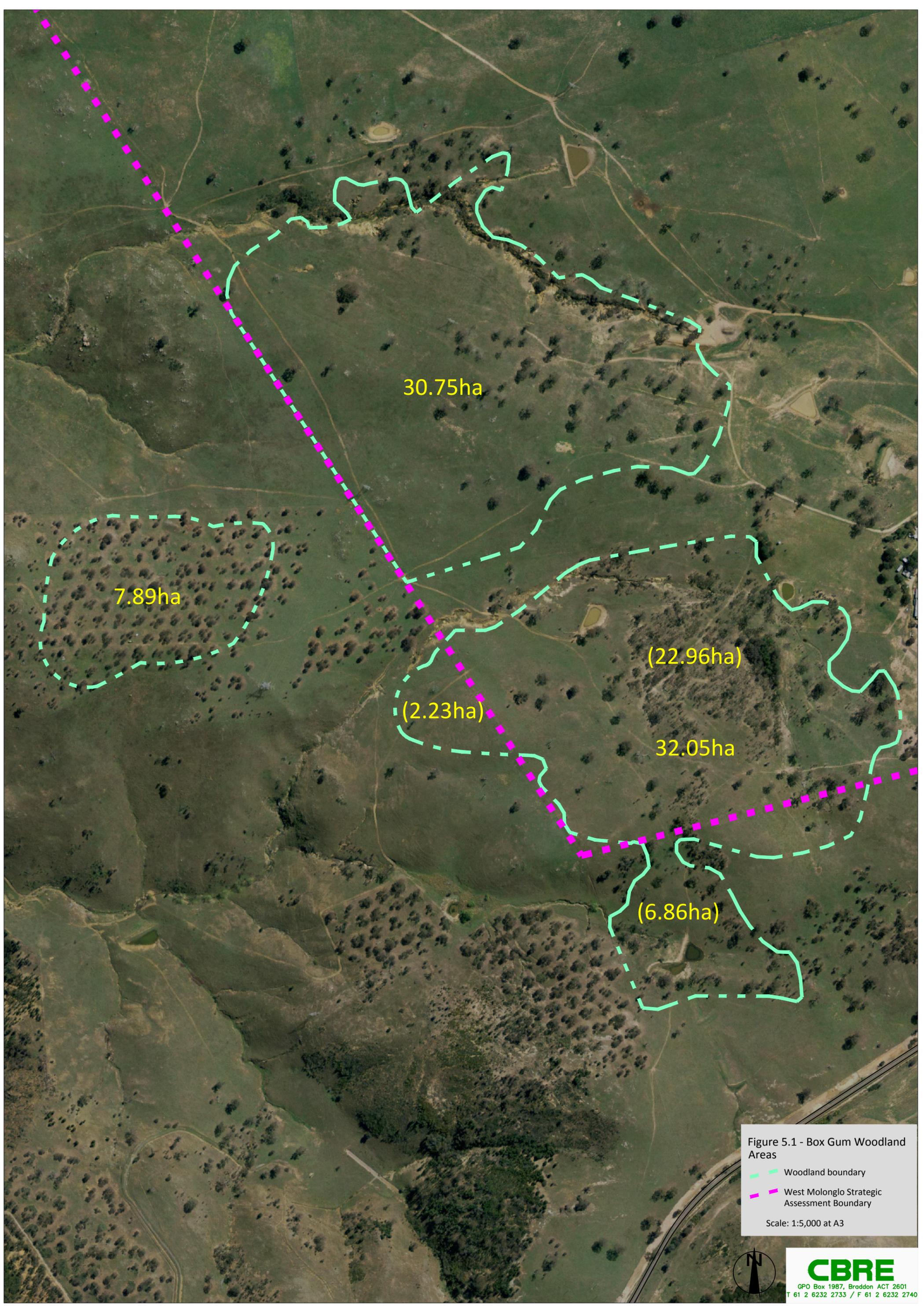
Figure 4.4 - Survey results

- Unit 1A
- Unit 1B
- Unit 1C
- Unit 2
- Unit 3A
- Unit 3B
- Unit 3C
- NOT DESIGNATED Unit 4
- Unit 5
- Unit 5A
- Unit 6
- Unit 7
- Unit 8

All lines are indicative only  
Scale: 1:7,500 at A3

- TRANSECT RESULTS**
- Native
  - Native but high proportion of introduced annuals
  - Marginal (45-55% native)
  - Marginal with high proportion of introduced annuals
  - Not native





30.75ha

7.89ha

(2.23ha)

(22.96ha)

32.05ha

(6.86ha)

Figure 5.1 - Box Gum Woodland Areas

- Woodland boundary
- West Molonglo Strategic Assessment Boundary

Scale: 1:5,000 at A3

