Proposed Molonglo Urban Developments and their Significant Impact on Endangered Woodlands

A report prepared by the Conservation Council ACT Region

June 2008

Summary

The lower Molonglo Valley supports woodland of national importance. A large proportion of the proposed Molonglo urban development area currently supports White Box - Yellow Box - Blakely's Red Gum Grassy Woodlands and Derived Native Grasslands, an ecological community nationally listed as endangered under ACT and Commonwealth legislation.

The purpose of this study was to specifically apply the Commonwealth legislation criteria to the woodlands in the Molonglo urban development area in order to determine the national significance of the impact of the proposed development. The report then applies NSW and Victorian biodiversity offset methodologies to demonstrate what would be required in other jurisdictions to achieve no net loss of biodiversity whilst allowing part of the development.

Development of East and West Molonglo and North Weston will result in the direct loss of up to 871ha of Yellow Box – Blakely's Red Gum Grassy Woodland. This loss would be a significant impact on this critically endangered community, and is contrary to both national and ACT conservation targets.

Development of the Central Molonglo area is still proposed in the current Draft Variation to the Territory Plan despite the ACT Government's recent declaration of a 'moratorium' on urban development in the Central Molonglo area. Development of the Central Molonglo area would result in the direct loss of an additional 563ha of Box –Gum woodland.

The vegetation and many of the composite plant and animal species on Canberra's Plains are already in decline. Any further clearing will worsen the problem. The precautionary approach would be to ensure that any loss of biodiversity caused from further clearing is offset by gains in biodiversity made from better conservation management elsewhere.

Application of the Biobanking (NSW) and Habitat Hectares (Victorian) offsetting tools to the Molonglo Valley area indicates that the proposed Kama Reserve would need to be at least 10 times bigger for it to offset the losses to endangered woodland that will result from the Molonglo urban expansion.

For the Molonglo development to approach biological sustainability it should involve less clearance of Box - Gum woodland and creation of a large conservation area centered on Central Molonglo. This area could become one of the key areas of woodland conservation in Australia, and balance the loss of biodiversity that will eventuate from urban expansion in the rest of Molonglo.

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1. Introduction

The ACT Government has committed to ecologically sustainable development in various policies and legislation. Specifically, the ACT Natural Resource Management Plan and the ACT Lowland Woodland Strategy seek to maintain and improve the natural integrity of the remaining lowland woodland ecosystems in ACT, while retaining the current extent of Yellow Box - Blakely's Red Gum Grassy Woodland.

The Commonwealth Government has recognised Yellow Box - Blakely's Red Gum Grassy Woodland as a matter of national environmental significance, and has legislation which seeks to prevent significant impact on the ecological community.

This report details the extent and conservation value of Yellow Box - Blakely's Red Gum Grassy Woodland within the proposed Molonglo development areas and assesses the significance of the proposed urban developments on the endangered woodlands. It applies nationally accepted methodologies to determine what would be required for the development to pass tests of ecological sustainability and avoidance of significant ecological impact.

The purpose of this study and report was to specifically apply the Commonwealth legislation criteria to the woodlands in the Molonglo urban development area in order to determine the significance of the impact of the proposed development from a national perspective. The report then applies NSW and Victorian biodiversity offset methodologies to demonstrate what would be required in other jurisdictions to achieve no net loss of biodiversity whilst allowing truly sustainable development across part of the Molonglo area.

The Biodiversity Working Group of the Conservation Council ACT Region has prepared this report. A list of member groups of the Biodiversity Working Group is at Appendix 3.

The author of the report is Dr Michael Mulvaney, who prepared the successful nomination to list Yellow Box - Blakely's Red Gum Grassy Woodland as a nationally threatened ecological community. Dr Mulvaney has also been an expert witness in several court cases involving illegal clearing of this ecological community and contributed to the development of the Property Vegetation Planning and Biobanking vegetation clearing offset tools employed in NSW.

The report is based on a field survey undertaken in Autumn 2008 in the Molonglo area. Andrew Zelnik, Geoff Robertson, Margaret Ning, Jenny Bounds, Catherine Potter, Andy Russell and Tony Lawson supported Dr Mulvaney in the field survey that underpins this report.

The full plant species lists at Appendix 1 were provided by the Parks, Conservation and Lands section of the ACT Department of Territory and Municipal Services, which made available all vegetation species data, condition data, habitat data and maps for the study area.

1.1 Woodland Definitions

A large proportion of the proposed Molonglo urban development area currently supports White Box - Yellow Box - Blakely's Red Gum Grassy Woodlands and Derived Native Grasslands, an ecological community nationally listed as critically endangered under the Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The Commonwealth definition excludes heavily degraded areas that were formerly part of the ecological community. However, low condition remnants are included if they still retain high viability.

The Commonwealth Department of the Environment and Heritage (DEH 2006) provides specific inclusion criteria for determining whether a community qualifies under the EPBC listing. The key factors are that:

1. White Box, Yellow Box or Blakely's Red Gum are or were a common overstorey species;
2. at least 50% of the perennial vegetation cover in the ground layer is made up of native species; and
3. either there are at least 20 mature trees per hectare or within a remnant patch there must be at least one 0.1ha area in which there are 12 or more native understorey species present (excluding grasses and including at least one plant on a provided list of important species).

A patch is a continuous area of the ecological community that retains a predominately native perennial understorey. Thus, the Commonwealth criteria include low diversity native pasture, if that pasture has a continuous connection to a remnant of high diversity of native species (even if that pasture is dominated by just one or two native grasses such as *Stipa* or *Danthonia*).

The ACT is on the eastern limit of the nationally listed White Box - Yellow Box - Blakely's Red Gum Grassy Woodlands and Derived Native Grasslands. White Box woodlands do not occur in the ACT.

A subset of the Commonwealth ecological community, Yellow Box - Red Gum Grassy Woodland, is listed as endangered in the ACT. The ACT listing only includes woodland in moderate or better condition. There are no specific inclusion criteria, rather Action Plan 27

provides guidance on what should be included in a community and allows for the fact that at different times of year there will be different levels of species present. Action Plan 27 includes mapped occurrences of the community according to whether at the time of mapping an area was judged to have a moderate or better diversity and cover of native species – that is, whether it was moderately or partially modified (ACT Government 2004).

1.2 Box – Gum Woodland – the National Context

Yellow Box – Blakely's Red Gum Woodland once covered about 25,000 square kilometres, as the eastern most of the temperate woodlands. It stretched as a 150 – 200 km wide belt from Melbourne to north of Toowoomba, between the 400mm and 800mm isohyets.

Growing on fertile soils it has been extensively cleared and degraded by agricultural activity. Over 90% of all Yellow Box and Blakely's Red Gum trees have been cleared. In most of the treed areas that remain, grazing and pasture-improvement have effectively removed the characteristic understorey, leaving only the overstorey trees with an understorey dominated by exotic species. As a consequence of these pressures, there are only a small number of areas remaining that retain a highly diverse understorey dominated by native, perennial tussock grasses.

The EPBC Scientific Committee considers that less than 5% of the ecological community remains nationally (DEH 2005). That is, over 95% of the community has been destroyed.

Remnants are extremely rare, and usually quite small and fragmented in size (Prober & Thiele 1995, Gibbons and Boak 2000). In the NSW portion of the Murray River Catchment there are no Yellow Box – Red Gum Woodlands greater than 100ha and only 1% of the extent woodland is estimated to be in patches greater than 10ha (Davidson 2003).

There are no Yellow Box – Red Gum Grassy Woodland patches greater than 250ha in South-east NSW (Rainer Rehwinkel NPWS Project Officer Pers. Comm. 2003), while in Victoria patches over 100ha are exceptionally rare and have generally been significantly degraded by overgrazing (Kate Stothers, Regional Flora and Flora Planner, Benalla Pers. Comm. 2003). Remnants greater than 200ha are extremely rare. There are only four patches left in Australia of 1000ha or more and all are in the ACT (ACT Government 2004).

On the Tablelands, Yellow Box – Blakely's Red Gum remnants may occur amongst native pasture. Fallding (2002) found that as much as 39% of the pre-clearance Yellow Box – Blakely's Red Gum Woodland may still exist, in the ACT and NSW Southern Tablelands, as a mixture of remnant treed patches and native pastures. Native pastures are usually of low diversity, but not always (McIvor 2002), and lack many of the functional aspects of the community. They are best considered as areas with the potential for the Box – Gum community to be restored.

1.3 Box – Gum Woodland – the ACT Context

The Australian Capital Territory contains the largest remaining remnants of Yellow Box - Blakely's Red Gum Grassy Woodland in good condition anywhere in the country, most likely reflecting lower levels of grazing, pasture improvement, cropping, fertilisation and clearing than in the rest of the range of the ecological community. In terms of size, connectivity, diversity and condition, the ACT remnants are exceptional, especially the presence of larger patches (over 100ha) in good condition (ACT Government 2004, DEH 2005).

The ACT Government (2004) mapped 10,685ha of partially and moderately disturbed Box – Gum woodland in the ACT, and estimated that it had once occupied about 32,000ha. Thus there is about 34% of the original extent of this community remaining in the ACT. Since 2004 there has been an additional 700 hectares of Box – Gum woodland put into conservation reserves, however, less than 12% of the original extent of this community is reserved in the ACT.

The ACT Natural Resource Management Plan 2004 – 2014 has the aspirational goal of managing for biodiversity conservation a minimum of 30% of the pre-European extent of each vegetation community occurring in the ACT.

Thus all remaining remnants of Yellow Box – Blakely's Red Gum woodland are of conservation significance and important to retain or at least offset, for the future sustainability of ACT's biodiversity.

2. The Occurrence of Box - Gum Woodland at Molonglo

To determine the impact on nationally significant Box – Gum woodland it is important to accurately map the extent, condition and connectivity of this ecological community within the proposed development area.

Biosis (2006) was contracted by the ACT Planning and Land Authority to prepare an Ecological Impact Review for the proposed Molonglo development. The specifications for this work did not involve any opportunity for field work so they relied on data from surveys undertaken by the ACT Government in 2004, which indicated that about 845ha of partially and moderately modified woodland and derived grassland would be destroyed across the whole Molonglo Valley by the proposed development. This equates to 7.8% of the remaining Box – Gum woodland in the ACT or 2.6% of the original extent.

About 600ha of Box - Gum woodland and derived grassland was mapped by the ACT Government (2004) as occurring in Central Molonglo. This area would be amongst the twenty largest remnants of Yellow Box – Blakely's Red Gum Woodland remaining in Australia. Only 175ha of this would be protected in the proposed Kama Reserve.

Biosis (2006) reliance on the ACT Government 2004 mapping is influenced by a number of factors:

1. Both diversity and condition of woodland remnants will change over time depending on climatic conditions, management practices and weed invasion. Woodland in the Molonglo area was surveyed and mapped by the ACT Government in 2004 after the 2003 fires, although this did not include the burnt pine areas, and stock has been removed from parts of the area since. Consequently there has been regeneration of Box – Gum woodland in much of the burnt out former pine plantations, south of the Molonglo River, while removal of stock has resulted in the expansion of moderate condition woodland in areas such as North Weston;

2. The ACT mapping can be interpreted as a subset of the Commonwealth listed community. The ACT mapping draws a line at moderate diversity, while the Commonwealth criteria have been written to include all viable areas and draws the line by an area having a predominately native understorey; and

3. The ACT mapping did not map smallish remnants such as roadside strips, or drainage lines or rocky areas within pine plantations that were never planted out. The sum of these small areas in the Molonglo area is around 70ha.

3. Conditions of Box-Gum Woodland within the Molonglo Area

As survey and mapping of Box – Gum woodland in the Molonglo area as prescribed under the EPBC criteria had not previously been undertaken, Dr Mulvaney and the Conservation Council's Biodiversity Working Group undertook field survey and mapping of the proposed Molonglo urban development area in Autumn 2008.

The methodology for the survey involved searching continuous areas of native vegetation for a significant species. A continuous area is one where native species make up more than 50% of the perennial ground cover and which is unbroken by roads, or areas of exotic understorey. Once located, a 50m tape was laid out and native species 10m either side of the tape recorded. The 50m tape was also used to measure cover as per the NSW biometric methodology.

The mapping shows the extent, condition and connectivity of the ecological community as defined under the Commonwealth EPBC Act across the proposed development area.

Box – Gum woodland in the Molonglo area occurs in the forms of diverse remnant patches that may or may not still retain trees, native pastures adjoining such remnants, and regenerating woodland within former pine plantations. Map 1 shows the distribution of the different conditions of the Box – Gum community across the Molonglo development area. Table 1 gives the extent of each condition type within the development area.

Appendix 1 lists the plant species recorded in each condition type. It should be noted that the survey occurred in late Autumn, a time when many native annuals would not be apparent and after prolonged drought conditions, so that the species lists will not be any where near comprehensive list of the native plant species that occur in the area.

The species list also contains vegetation survey data from the ACT Government surveys taken at other times throughout the year, as supplied by the Parks, Conservation and Lands section of the ACT Department of Territory and Municipal Services.

The Biosis (2006) report considered that part of the proposed Molonglo development area was natural temperate grassland, and it is likely that grassland did occur below the cold air drainage line. The distinction between natural and secondary grassland (derived from Box-Gum woodland) is difficult to make, on the ground. However the presence of paddock trees and relic stumps indicates that most of the grassland in the development area is secondary – that is, it was once woodland. For ease of assessment, this report has adopted the boundary of Box - Gum woodland modelled in Fallding (2002).

Following is a summary of the findings from the field survey on the mix and extent of Box – Gum woodland condition types.

3.1 Partially and moderate disturbed remnants

These areas either retain greater than 20 mature trees per hectare, or the understorey contains a relatively large variety of herbs and grasses. These remnants all comprise Yellow Box – Red Gum woodland under the ACT Nature Conservation Act and also meet the Commonwealth EPBC criteria in terms of diversity and cover requirements.

The remnants identified in this report include those areas mapped by ACT Government (2004) as partially or moderately disturbed woodland. The exception being in part of the West Molonglo area, where weed invasion and current grazing practice appears to have reduced the extent of woodland. The Autumn 2008 survey of the Molonglo proposed development areas also located an additional 20ha of woodland in the North Weston Area and 34ha in East Molonglo.

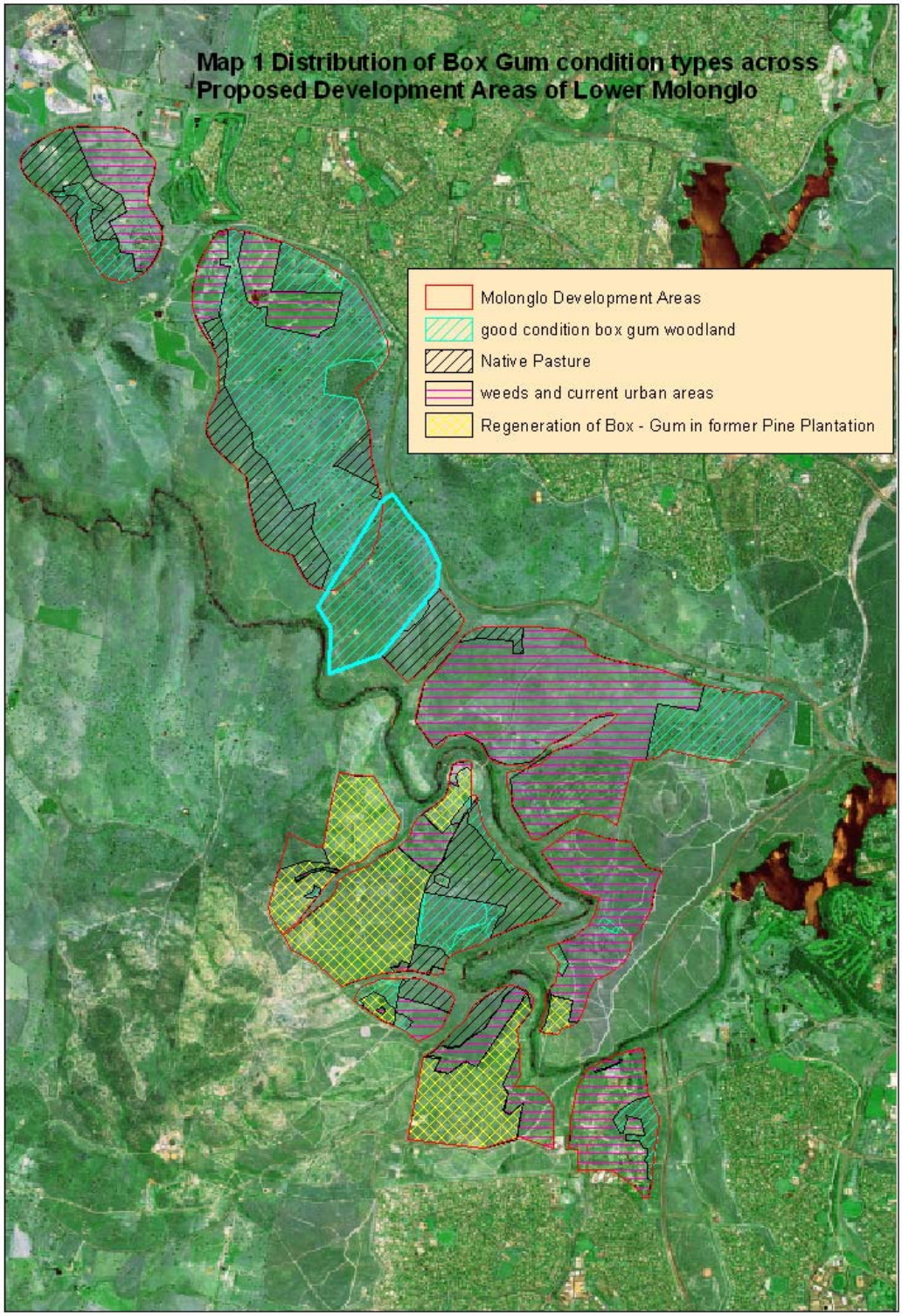
Map 1 Distribution of Box Gum condition types across Proposed Development Areas of Lower Molonglo
Molonglo Development Areas
good condition box gum woodland
Native Pasture
weeds and current urban areas
Regeneration of Box - Gum in former Pine Plantation

Table 1: Extent of each Vegetation Condition in the Molonglo Development Area

Sub-area	Extent of good condition Box – Gum Woodland (ha)	Extent of Native Pasture (ha)	Extent of regenerating woodland in burnt pine plantation (ha)	Extent of Non Native Vegetation (ha)
North Weston	20	-	-	105
East Molonglo	180	145	425	709
Central Molonglo	386 in development area + 175 in proposed Kama Reserve	177	-	100
West Molonglo	34	69	-	88
TOTAL	**795**	**391**	**425**	**1002**

3.2 Native pasture

Native pastures typically contain a native plant diversity of less than ten species, but native grasses occupy between 40 – 75% of the ground cover. These areas are continuous with remnants of higher diversity and thus meet the Commonwealth criteria for inclusion under the Box – Gum woodland listing.

68ha of native pasture were mapped in West Molonglo, 177ha in Central Molonglo and 145ha in East Molonglo.

3.3 Woodland regenerating in burnt pine plantations

Native grasses and herbs with a high diversity and presence of significant species dominate the understorey of 425ha of burnt pine plantation in the East Molonglo area south of the Molonglo River.

In ten 20m x 20m plots located in this area the range of native species diversity ranged from 12 to 26, with an average of 17 native species per plot. A total of 76 native woodland species including 19 significant species were recorded in burnt plantation. Several of the species observed such as *Lotus australis, Solanum cinereum* and *Sporobolus creber* are regionally uncommon (M. Mulvaney, personal observation). Eucalypts, particularly Blakely's Red Gum, are quite commonly regenerating across the burnt pines. The weed ground cover ranged from 10 to 38%, while pine regrowth is rampant.

Dry Forest in the ACT region has been successfully regenerated from burnt pine plantation and, although weed growth is relatively high, it is certainly possible that, with active weed control, a large part of the 425ha mapped could be regenerated back to endangered Box – Gum woodland.

The regenerating woodland in the burnt plantation also appears to support a high native invertebrate population. Several large flocks of native woodland birds were observed feeding or moving through the plantation areas. On four occasions flocks containing from 5 to 10 Double-barred Finches were observed. This bird has become uncommon in other areas of the ACT. Several raptor species (birds of prey) were also observed hunting in the burnt out plantation area

Areas in which perennial weeds form the predominate ground cover were excluded from inclusion as Commonwealth listed Box – Gum woodland. Most of the pine plantation north of the Molonglo River was also excluded for, although much of this area has an understorey dominated by native grasses, it lacks the diversity and abundance of significant species present that would qualify it for inclusion as the Commonwealth listed woodland. This finding indicates that there was a greater history of agricultural use and disturbance of the original ecological community north of the river, prior to the planting of the pines.

3.4 Dry Forest

Small areas of Dry Forest dominated by Red Stringybark, Scribbly Gum and Brittle Gum occur in East and Central Molonglo. These forests are not considered here. Neither is the significant riparian vegetation that would be drowned by the proposed lake.

3.5 Areas not supporting native vegetation

About half of the West and East Molonglo and North Weston areas do not support native vegetation or the native vegetation is in poor condition and/or too fragmented to be considered as part of the Yellow Box – Blakely's Red Gum Woodland community. These areas largely consist of burnt pine plantation now dominated by Blackberry, St John's Wort, Chilean Needle Grass or African Love Grass, or pasture dominated by exotic grasses such as Goosegrass and Phalaris.

3.6 Summary of condition mapping

The East and West Molonglo areas together with North Weston contain in the order of 873ha of Box- Gum woodland according to the Commonwealth's EPBC criteria. About half of this area is regenerating woodland in burnt former pine plantation. Around a quarter of the area is low diversity native pasture, while the remainder of the area has high plant species diversity.

The Central Molonglo area, including the proposed Kama Reserve and land north of Deep Creek, contains in the order of 738ha of Box – Gum woodland according to the Commonwealth's EPBC criteria. Three quarters of this is a diverse and very large woodland remnant, the rest is native pasture continuous with the woodland remnant.

4. Significance of Impact of Proposed Development on Box – Gum Woodland

Recently the ACT Chief Minister announced a moratorium on clearing of the Central Molonglo area. However, the current *Draft Variation to the Territory Plan No 281 – Molonglo and North Weston* released in April 2008 still includes the Central Molonglo area for rezoning for future urban development.

For the purposes of this report, it has been assumed that the whole of the Central Molonglo area is excluded from urban development and rezoned for conservation management in perpetuity. It should be noted that if any of the Box – Gum woodlands in the Central Molonglo area are included in future urban expansion then the significance of the impact of the Molonglo development will be much greater than that documented below.

Excluding the Central Molonglo area, the proposed urban expansion in East and West Molonglo and North Weston would result in the direct loss of up to 873ha of Box-Gum woodland, as well as significant indirect impacts on remaining woodland in the vicinity of the urban expansion. An additional 563ha would be lost if the Central Molonglo woodlands that occur outside the small proposed Kama Reserve are destroyed for urban development.

873 hectares is a very large and significant amount of critically endangered woodland to be losing. By example, this area is equivalent to a fifth of the total extent of Box – Gum woodland remaining over the whole Boorowa Shire, an area that used to support 74,340ha of woodland (Priday et al 2002).

Nationally 95% of this community has been destroyed. Retaining at least 30% of the estimated pre-1750 extent of each vegetation community is a national objective. Box – Gum woodland has reached a level of national clearance that any further losses are significant and contrary to conservation targets.

The significance of the anticipated loss in Molonglo is heightened by the fact that ACT's remnants are the largest and least fragmented in the country. In terms of maintaining functional landscapes of Yellow Box – Blakely's Red Gum Woodland, the lower Molonglo is of national importance.

Biosis (2006) suggests that the loss of 845ha of woodland (including Central Molonglo) would not be significant at the ACT level, but then recommends referral to the Commonwealth, when their consideration is only triggered by potential significant impact.

Biosis (2006) describe that under the Commonwealth's Comprehensive, Adequate and Representative (CAR) criteria a minimum of 15% of the pre-1750 distribution of each forest system should be protected in a formal reserve. However, the CAR criteria relate to forested landscapes where greater than 70% of the pre-1750 vegetation remains and many of the vegetation and habitat values will be retained in surrounding State Forests.

Biosis used the extent of remaining woodland in the ACT reserve system (27%) as a rationale for saying loss of woodland in the ACT would be not be significant, although the

ACT Government (2004) gives the percentage of reservation of Box – Gum woodland as under 10% of the pre-1750 distribution. The reservation figure has increased since 2004, but not to the extent that a 15% reservation is met. This target of 15% would require reservation of about half of all remaining Box – Gum woodland in the ACT.

As previously stated the key conservation criteria applied to Box – Gum woodland is to retain 30% of the pre-1750 extent, while the Murrumbidgee Catchment Plan, seeks to place 30% of each vegetation type under some form of conservation management.

5. Offsetting for Sustainable Vegetation Outcomes

As noted in the ACT action plans for lowland woodlands, temperate grasslands and riparian areas, the vegetation and many of the composite plant and animal species on Canberra's Plains are in decline. Any further clearing will worsen the problem. The precautionary approach would be to ensure that any loss of biodiversity caused from further clearing is offset by gains in biodiversity made from better conservation management elsewhere.

NSW, Victoria and South Australia have adopted such a sustainable or "net gain" approach, where approval to clear vegetation is reliant on the provision of suitable offsets. Under these systems clearing of native vegetation is allowed only as a last resort, after all feasible mitigation measures have been taken, and after it has been shown that the biodiversity loss resulting from clearance can be offset. Offsets do not replace cleared vegetation, rather clearing is only allowed if offsets enhance remnants to an extent that is expected to at least match the biodiversity loss caused by clearance.

Offsets are determined through calculating the biodiversity lost in the clearance area, and matching that with biodiversity gains that can be made through long term conservation management actions in offset areas. The size of offsets required will vary depending on the size and condition of the clearance area, and the condition of the offset area and prescribed management actions.

Despite claims that Molonglo is all about sustainable development, there has yet to be any calculation by government of the biodiversity loss caused or what might be an appropriate offset. The ACT Government has also not adequately defined what it means by sustainability in this context and does not justify how it is possible to clear hundreds of hectares of native vegetation and still be sustainable, without offsetting measures.

This report applies biodiversity offset methodologies from other jurisdictions to demonstrate what would be required in those jurisdictions to achieve no net loss of biodiversity (a measure of sustainability) whilst allowing the East Molonglo and North Weston urban developments. These have been applied by the Conservation Council as a way of illustrating how other jurisdictions are approaching biodiversity management and achievement of biodiversity sustainability, especially in relation to endangered ecological communities.

There are several available offset methodologies that could be applied to the Molonglo situation. This report employs the Habitat Hectares methodology of the Victorian Government and the Biobanking methodology of the NSW Government to give an indication of what might be an appropriate offset for the Molonglo development area.

The biobanking (urban and infrastructure developments) and the Property Vegetation Plan Tools (rural clearing), applied in NSW would prohibit clearing of any of the Box Gum vegetation in the Molonglo area. This is because, sustainable outcomes are predicated on the reasoning that no further clearing of native vegetation is permitted in vegetation types or landscapes that are already overcleared (>70% clearance) or listed as threatened at the national, state or regional scales, unless that vegetation is in low condition. To be in low condition vegetation has to have **both** an understorey in which more than 50% of the vegetation cover is weeds and an overstorey that has been cleared to at least a quarter of the normal overstorey extent.

The NSW legislation underpinning biobanking does allow the prohibition to be over ridden if there is strong social justification to do so, but this would then require substantial offsetting measures. For example, the proposed development of 181,000 new homes in Western Sydney has been allowed on the proviso that all high condition remnants of endangered Cumberland Plains Woodland larger than 10ha are protected and the loss of a few thousand hectares in total of small or poor condition remnants are offset by the creation of a $530 million trust fund to acquire and manage offsets.

The Victoria Habitat Hectares approach does not have outright prohibitions, but requires increasingly large, and generally prohibitive offsets, for clearance of large areas of endangered woodland.

5.1 The offset required for Molonglo by the NSW Biobanking methodology

Biobanking allows 'biodiversity credits' to be generated by landowners who commit to enhance and protect biodiversity values on their land. These credits can then be sold. Developers can buy these credits and use them to counterbalance (offset) the impacts on biodiversity values that are likely to occur as a result of development. Offsets have to be of a similar vegetation type to that being cleared (www.environment.nsw.gov.au/biobanking/biobankingqa.htm).

The NSW Government describes Biobanking by the following example;

> "Suppose a landowner lives on 200 hectares of land at Picton that includes 150 hectares of Cumberland Plain Woodland of high conservation significance. The landowner could enter into a biobanking agreement whereby the 150 hectares becomes a biobank site. Actions by the landowner to control grazing, weeds and foxes for the protection of habitats and breeding of rare mammals and birds would generate 'biodiversity credits' that the landowner can sell.
>
> Suppose also that a developer is proposing a new residential development near Liverpool, but the building of houses will impact on a small area of Cumberland Plain

Woodland. Using the prescribed methodology, the developer would work out the number of credits needed to offset the impact of the development and apply for a biobanking statement which sets out the number and class of credits required. The developer could then purchase the credits from the Picton landowner."

In the biobanking methodology ten vegetation attributes are used as surrogates to measure the biodiversity found at a particular site. These attributes include native plant diversity, tree, shrub, grass and weed cover, the number of hollow bearing trees and the amount of fallen timber. Comparison of these variables against benchmark (or natural condition) figures provides a biometric. This biometric is then multiplied by the size of the offset or development site involved. The potential presence of threatened species within an area will trigger a further multiplication factor. The degree of multiplication will depend on the threatened species involved and how readily their populations may be increased through sympathetic management actions. Those that respond poorly will require much larger offsets than those that readily respond.

Required biobanking "clearance" credits were determined individually for the different conditions of Box - Gum woodland that occur in West and East Molonglo and North Weston. Biobanking "offset" credits were determined for Central Molonglo (including Kama woodlands). Details of the vegetation attributes collected by plot data across the Molonglo area are provided at Appendix 2.

The only threatened species considered likely to currently use the burnt pine plantation was the Diamond Firetail. This small bird species responds relatively well to favourable management actions. Thus the credits generated per hectare of clearance in this environment are less than that required for native pastures and Box – Gum woodland, which could be used by a range of threatened species including the Pink-tailed Worm Lizard, several bats, Regent Honeyeater, Brown Treecreeper, Diamond Firetail and Golden Sun Moth.

The biobanking credits required or generated are tabled below.

Table 2: Biobanking credits required by North Weston, East Molonglo and West Molonglo development proposals

Box- Gum condition type	**Area to be cleared (ha)**	**Credits required**
Good condition Box – Gum woodland	234	17,792
Native Pasture	212	16,982
Regenerating in burnt pine plantation	425	16,119
TOTAL OF ALL TYPES	**871**	**50,893**

Table 3: Credits generated if Central Molonglo is managed as an offset

Box- Gum condition type	**Offset Area (ha)**	**Credits generated**
Good condition Box – Gum woodland	738	7589

To sustainably offset the loss of Box - Gum woodland in the development areas an offset area 6.7 times the size of the combined Central Molonglo woodland area and Kama woodland would be required. This offset would also need to be in similar condition to that of the Kama/ Central Molonglo area, and be managed primarily for conservation.

5.2 The offset required for Molonglo by the Victorian Habitat Hectares methodology

Habitat Hectares is a three step approach. Firstly it seeks to avoid adverse impacts through evaluation of options to avoid clearing. If avoidance is not possible, options to minimise impacts are investigation and only then are offsets considered.

Similar to biobanking, Habitat Hectares is a site-based measure of quality and quantity of native vegetation that is assessed against a benchmark for that native vegetation type (or Ecological Vegetation Class – EVC). There are over 800 EVC mapped in Victoria and they are specific to each bioregion. There is no direct EVC comparison to Yellow Box – Blakely's Red Gum woodland of the ACT, but the closest match is Plains Grassy Woodland/Valley Grassy Forest Complex of the Northern Inland Slopes bioregion. Of the 26 species listed as typical of this community, 23 have been recorded in East Molonglo.

The Habitat Hectares assessment assigns a habitat score to a habitat zone that indicates the quality of the vegetation relative to the EVC benchmark. This habitat score is then multiplied by the area of the habitat zone to determine the quality and quantity of vegetation (DSE 2004). The components of the "habitat score" and their relative weightings are shown below in Table 3. Each of the Box – Gum woodland conditions present in the Molonglo area are considered a habitat zone. The habitat score components for each of these zones are also shown in Table 3.

Table 3: Components and weightings of the Victorian habitat score

	Component	**Score**	**Box-Gum**	**Pasture**	**Plantation**
Site Condition	Large Trees	**10**	8	3	0
	Tree Canopy Cover	**5**	5	0	0
	Understorey	**25**	20	5	20
	Lack of Weeds	**15**	9	9	6
	Recruitment	**10**	6	0	3
	Organic Litter	**5**	5	3	2
	Logs	**5**	2	0	2
Landscape Context	Patch Size	**10**	10	8	8
	Neighbourhood	**10**	8	8	8
	Distance to Core Area	**5**	5	5	5
	Total	**100**	**78**	**41**	**54**

Table 4: Habitat Hectares for Different Box – Gum Condition types

Box – Gum condition type	Area to be cleared (ha)	Habitat score	Habitat Hectares	Conservation significance + weighting	Gain Target
Good condition Box - Gum	234	0.78	182.5	VH (x2)	**365**
Native Pasture	212	0.41	86.9	H (x1.5)	**130**
Regenerating in burnt pine	425	0.54	229.5	H (x1.5)	**344**
TOTAL			498.9		**839**

A further calculation is required which multiples the Habitat Hectare score against a weighting according to the conservation significance of the vegetation being cleared. The resulting figure is termed the gain target, which is the amount of biodiversity gain that needs to be achieved to offset a loss measured in habitat hectares. An endangered community is considered to have very high or high significance, depending on whether the remnant being cleared is considered to be in the top 50% of the habitat of that vegetation type in the region.

The gain target needs to be met by an offset gain, which is an increase in the extent, quality or security of native vegetation in perpetuity through the establishment of an offset. A security gain enhances the on-going management and protection of native vegetation. An example is transferring private land to a secure public conservation reserve. A maintenance gain can eventuate from commitments in perpetuity to forego entitlements such as cutting firewood for personal use. An improvement gain eventuates from commitments to undertake conservation management actions that improve current vegetation quality.

The Victorian Department of Sustainability and Environment has produced a Gain Calculator that can be down loaded from the web site
www.dse.vic.gov.au/.../0/1DED024517755A63CA257236001E9227/$File/Gain+Scoring+Web+Ver1.1+14+07+06.xls

The offset gain is significantly influenced by the management actions to which a landowner is prepared to commit, and whether or not land is transferred to public ownership with the primary objective of conservation. If it is assumed that an offset area will become a conservation reserve and the following management actions will occur (exclude stock, retain all standing trees, retain all fallen timber, eliminate (reduce to <1% cover over 10 year management period) high threat weeds, control pest animals, undertake supplementary planting and introduce logs) then an offset of 1650ha would be required of similar habitat to that of Kama woodland and other Central Molonglo woodland.

If the Central Molonglo area was to remain under lease and only the minimum management conditions agreed to (exclude stock and control spread of high threat weeds - ensure cover does not increase beyond current levels in perpetuity), then the offset area required is 7500ha of similar habitat to that of Kama woodland and other Central Molonglo woodland. If the land was to remain under lease and the full range of management actions were agreed to then the offset required would be 3750ha in area.

Thus at best, under the Victorian system and legislation, the proposed development of East and West Molonglo and North Weston would require an offset two and a half times the total combined size of the proposed Kama Reserve and all Box - Gum woodland in Central Molonglo. This offset area would have to be a dedicated public conservation reserve and be subject to fairly intensive conservation management.

6. Conclusion

The lower Molonglo Valley supports woodland of national importance. The loss of 871ha of Yellow Box – Blakely's Red Gum woodland through development of East and West Molonglo and North Weston (not including Central Molonglo) would be a significant impact on this critically endangered community.

Ecologically sustainable planning would avoid the loss of endangered woodland, by directing development onto areas that do not support native vegetation. Given the unusually large extent of Box – Gum woodland in Canberra and its population growth, avoiding all endangered woodland is problematic. Nevertheless, the sustainability of Canberra's biodiversity requires that loss of vegetation and habitat be minimised and that any loss is offset through gains that can be made through improved management and security of woodland areas that are not to be developed.

As yet the development proponents have not documented the biodiversity loss that will eventuate from the urban expansion, while about 175ha of the Kama woodland is proposed as a nature reserve. Use of the NSW and Victorian "no net loss" tools indicates that the proposed Kama Reserve is 9.5 times too small under the least area Victorian offset option and 28 times too small under the least area NSW option to be considered an adequate offset.

A twenty year moratorium has been declared over the Central Molonglo area. However, without active conservation management it is unclear whether any biodiversity gain would occur over this area, or in fact that stock grazing and weed invasion would not result in biodiversity loss. Current management is at best maintaining native plant cover, but appears not to be producing any substantial improvement in species diversity, community structure or ecosystem functioning.

Even if all of the woodland at Kama and Central Molonglo was dedicated as a conservation reserve and managed intensively for conservation, it is still two and a half times too small under the Victorian system and six and a half times to small under the NSW biobanking.

7. Recommendations

For the Molonglo development to approach biological sustainability it should involve less clearance of Box - Gum woodland and creation of a large conservation area, centered on Central Molonglo.

It is recommended that a large Kama/Central Molonglo conservation area should extend from Deep Creek up to at least the vineyards south of Pegasus and incorporate woodland south of Drake Brockman Drive. It should be extended westwards to connect along its entire length with the Molonglo River and consideration should be given to also incorporating woodland to the southwest of the Molonglo River outside the development zone (see Map 2 – Sustainable Development of the Lower Molonglo Valley).

A substantial core of the area should be zoned as a nature reserve and the balance of the area could be managed as rural leases for conservation purposes. This whole of this area should include conservation management actions that are favorable to the expansion of threatened species populations that occur in the Molonglo area, for example, the continued importation of logs for the Brown Treecreeper, or the planting of shrubs out from the riparian corridor for the Diamond Firetail.

It is also recommended that the following additional Box – Gum woodland areas be excluded from clearing:

- sizable components of the Box - Gum woodland in the south-east section of North Weston adjoining Tuggeranong Parkway
- the large areas of good condition woodland within the southern section of the East Molonglo area
- the woodland in the north-east section that adjoins the arboretum
- the native pasture between Kama and Deep Creek; and
- woodland to the west of Strathnairn (see Map 2).

The woodland near the arboretum could be enhanced to be a natural feature of the arboretum complex, while the woodland along the Molonglo River corridor would be particularly valuable in terms of connectivity, assuming that a future lake does not drown the riparian valley.

When considering the sustainability of the Molonglo urban expansion, the significant indirect impacts on the biodiversity of neighboring areas need to be factored in. These indirect impacts could come from a wide range of causes including increased weed invasion, the need for fire management activities, potential impacts of pet cats and dogs, and increased recreational use and subsequent ground disturbance.

Domestic cats, roaming mainly at night, kill many thousands of wildlife every year in Canberra. Greatest potential impact is in undisturbed habitat near new residential development (Barratt 1997). One cat was radio tracked to have moved 900m from a residential house in one night. There is also a clear link between the size of feral cat populations and closeness to urban environments (Barratt 1998). Cat predation of local

wildlife is likely to significantly deplete, the food resources of the different raptor species, which currently occupy the lower Molonglo Valley.

The suburbs of Forde and Bonner in Gungahlin ACT are declared cat containment zones. This means that residents of those suburbs choosing to keep a cat must keep it contained to their property. It is recommended that suburbs within the Molonglo urban development be declared as cat containment zones.

ACT's lowland vegetation has already been cleared to an extent beyond considering what is left as sustainable. The vegetation of ACT lowlands requires considerable active rehabilitation and regeneration activities, with particular focus on increasing the size, connectivity and condition of the larger remaining remnants.

The Central Molonglo area is a key area of both present biodiversity conservation value and regeneration potential. Under conservation management this area could become one of the key areas of woodland conservation in Australia, and balance the loss of biodiversity that will eventuate from urban expansion in the rest of Molonglo.


Map 2: Sustainable Development of the Lower Molonglo Valley
Proposed Conservation Area
Molonglo Development Areas
Good Condition Woodland that could be retained

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Appendix 1: Native Plant Species Recorded in Molonglo Area

Key

***** Significant species as listed by the Commonwealth

X Species observed in this survey

x Species only recorded by ACT Government from surveys undertaken in 2004. Data provided by the Parks, Conservation and Lands section of the ACT Department of Territory and Municipal Services.

Species	**Box- Gum**	**Native Pasture**	**Burnt Pine Plantation**
Acacia dealbata			X
Acacia implexa	X		X
Acacia mearnsii			X
Acacia melanoxylon			X
Acacia pravissima			X
Acacia rubida			X
Acaena ovina	X		X
Amphibromus nervosus	X		
Aristida ramose	X		X
Arthropodium milleflorum *	X		
Asperula conferta *	X		X
Bothriochloa macra	X	X	X
Bracteantha viscose	X		
Bulbine bulbosa	X		
Bursaria spinosa	X		
Calotis lappulacea *	X		
Carex appressa	X	X	X
Carex breviculmis	X		
Carex inversa	X		X
Cassinia hewsoniae			X
Cassinia longifolia	X		X
Cassinia quinquefaria	X		X
Chamaesyce drummondii	X		
Cheilanthes austrotenuifolia	X		
Cheilanthes distans *			X
Cheilanthes seeberi	X	X	X
Chenopodium pumilio	X	X	X
Chloris truncata	X	X	X
Chrysocephalum apiculatum *	X	X	X
Chrysocephalum semipapposum *	X		X

Convolvulus arvensis			X
Craspedia variabilis *	X		
Cryptandra amara	X		
Cymbonotus lawsonianus	X		
Cymbonotus sp.	X		
Cynoglossum suaveolens	X		
Danthonia species	X	X	X
Daviesia mimosoides *	X		X
Desmodium varians *	X		X
Dianella longifolia *	X		X
Dianella revolute *	X		X
Dichelachne sp.	X		
Dichondra repens	X		X
Dichopogon fimbriatus *	X		
Digitaria brownii	X		
Dillwynia sericea *	X		X
Discaria pubescens *	X		
Dodonaea viscose	X		
Enneapogon nigricans	X	X	X
Einadia nutans	X		X
Elymus scaber	X		X
Epilobium billardierianum	X		X
Erodium crinitum	X		X
Eryngium ovinum *	X		X
Eucalyptus blakelyi	X	X	X
Eucalyptus bridgesiana	X		X
Eucalyptus dives	X		
Eucalyptus melliodora	X	X	X
Eucalyptus pauciflora	X		
Eucalyptus rubida	X	X	
Eucalyptus viminalis			X
Euchiton sphaericus	X		X
Exocarpos cupressiformis	X		
Galium gaudichaudii	X		
Geranium solanderi	X		X
Geranium potentilloides	X		
Glycine clandestina *	X		X
Glycine tabacina *	X		X
Gonocarpus tetragynus	X		X
Goodenia hederacea *	X		
Goodenia pinnatifida *	X		
Haloragis heterophylla	X		X
Hardenbergia violacea *	X		X
Hibbertia obtusifolia *	X		X

Hydrocotyle laxiflora	X		
Hypericum gramineum	X		
Hypoxis hygrometrica	X		
Indigofera australis	X		
Isotoma fluviatilis	X		
Juncus sp 1.	X		X
Juncus sp 2.	X		X
Kunzea ericoides *	X		X
Leptorhynchos elongatus *	X		
Leptorhynchus sp. *	X		
Linum marginale *	X		
Lomandra filiformis	X	X	X
Lomandra longifolia	X		X
Lomandra multiflora	X		X
Lotus australis *	X		X
Melichrus urceolatus	X		X
Mentha diemenica	X		
Microlaena stipoides	X	X	X
Oxalis perennans	X		X
Panicum effusum	X		X
Persicaria prostrata	X	X	X
Pimelea curviflora *	X		X
Plantago varia *	X		
Poa labillardieri	X		
Portulaca oleraca	X	X	X
Pseudognaphalium luteo-album	X		X
Pultenaea procumbens *			X
Rubus parviflorus	X	X	X
Rumex brownii	X		X
Schoenus apogon	x		
Senecio quadridentatus	x		X
Solanum cinereum	X		X
Solenogyne dominii *	x		
Solenogyne gunnii *			
Sorghum leiocladum *	x		
Sporobolus creber	X		X
Stackhousia monogyna	X		
Stellaria pungens	X		
Stipa bigeniculata	X	X	X
Stipa densiflora	X	X	X
Themeda australis *	X	X	X
Tricoryne elatior *	X		X
Triptilodiscus pygmaeus *	x		
Typha orientalis	X		

Urtica urens	x		
Vittadinia cuneata	X		X
Vittadinia gracilis	x		
Vittadinia muelleri	X		X
Wahlenbergia communis	X	X	X
Wahlenbergia luteola	X		
Wahlenbergia stricta	X	X	X
Wurmbea dioica *	x		
Zornia dyctiocarpa *	x		

Appendix 2: Site Quality Data collected for Biobanking

	Box Gum Plots					Kama Plots			
Site Attribute	BG1	BG2	BG3	BG4	BG5	K1	K2	K3	K4
Number of native plant species	10	18	23	9	22	12	10	15	9
Native over-storey cover (%)	-	25	-	5	5	0.5	-	15	-
Native mid-storey cover (%)	0.5	25	-	-	5	-	-	15	-
Native ground cover (%) - grasses	44	20	25	66	58	30	30	65	40
Native ground cover (%) - shrubs	2	5	5	-	10	-	-	-	-
Native ground cover (%) - other	2	2	25	-	10	-	-	1	-
Exotic plant cover (%)	36	10	10	22	2	20	25	5	30
Number of trees with hollows	-	3	-	0.5	0.5	1	-	3	-
Over-storey regeneration	1	1	0.5	-	1	1	-	1	-
Total length of fallen logs (m)	-	5	5	2	-	2	-	25	-

	Native Pasture Plots						
Site Attribute	NP1	NP2	NP3	NP4	NP5	NP6	NP7
Number of native plant species	4	8	3	3	10	6	7
Native over-storey cover (%)	0.1	0.25	0.25	0.1	5	-	-
Native mid-storey cover (%)	-	0.1	-	-	-	-	-
Native ground cover (%) - grasses	62	42	76	56	60	30	50
Native ground cover (%) - shrubs	-	-	-	-	-	-	-
Native ground cover (%) - other	-	2	-	-	-	-	-
Exotic plant cover (%)	22	36	4	24	15	20	25
Number of trees with hollows	-	0.25	0.25	0.1	-	-	-
Over-storey regeneration	-	1	-	-	0.5	-	-
Total length of fallen logs (m)	-	-	-	-	2	-	-

Plots of Regenerating Woodland in Burnt Pine Plantation

Site Attribute	P1	P2	P3	P4	P5	P6	P7	P8	P9
Number of native plant species	18	12	12	13	12	15	22	21	26
Native over-storey cover (%)	-	-	-	-	-	-	-	-	-
Native mid-storey cover (%)	-	-	-	-	-	-	3	-	-
Native ground cover (%) - grasses	38	40	10	12	14	36	35	10	22
Native ground cover (%) - shrubs	0.5	-	-	2	2	-	2	2	5
Native ground cover (%) - other	2	8	24	22	22	8	6	22	8
Exotic plant cover (%)	21	34	32	28	28	38	10	30	14
Number of trees with hollows	-	-	-	-	-	-	-	-	-
Over-storey regeneration	0.5	-	-	-	-	-	0.5	0.5	1
Total length of fallen logs (m)	50	20	10	15	5	10	-	20	5

Appendix 3:

Member Groups of the Conservation Council Biodiversity Working Group

- Australian Native Plants Society Canberra Region
- Field Naturalists Association of Canberra
- Canberra Ornithologists Group
- Friends of Aranda Bushland
- Friends of Grasslands
- Ginninderra Catchment Group
- Molonglo Catchment Group
- National Parks Association ACT