EASTERN BROADACRE
PLANNING STUDY

ASSESSMENT OF ECOLOGICAL
OPPORTUNITIES AND CONSTRAINTS

D.McC. Hogg

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on behalf of
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EXECUTIVE SUMMARY

This report reviews the ecological issues relevant to the Eastern Broadacre Planning Study in terms of the potential constraints that these issues may generate in relation to the potential use of the Majura – Symonston – Jerrabomberra area as a future employment corridor for Canberra. This corridor contains many areas which are of high potential for biodiversity conservation in the ACT, either as nature reserves or as low intensity land uses which would be compatible with biodiversity conservation. Most of these areas contain threatened species or ecological communities which are protected under the Commonwealth Environment Protection and Biodiversity Conservation Act (EPBC Act) as well as the ACT Nature Conservation Act.

The analysis in this report is based largely on the extensive information collected by the ACT Government in preparing its series of Action Plans for threatened species and ecological communities. The important ecological attributes identified in these Action Plans which may be constraints on development are as follows:

- Natural temperate grassland, which is an endangered ecological community and is present in some low lying parts of the study area, supporting a number of threatened species.
- Remnant woodland, particularly yellow box – red gum grassy woodland, which is an endangered ecological community occurring on the lower slopes above the grassland, and providing habitat for several threatened bird species.
- The grassland earless dragon (Tympanocryptis pinguicolla), an endangered species which now appears to survive only in the study area and adjacent low lying areas in New South Wales. Because of its endangered status and the importance of the study area as its main habitat, this species is potentially a major constraint to land development and infrastructure works within the study area.
- Several other threatened animal species which are less significant as constraints because of their more limited occurrence within the study area, their presence in other areas within and outside the ACT and, in some cases, a lower threatened status. These include the striped legless lizard (Delma impar), the pink-tailed worm lizard (Aprasia parapulchella), the golden sun moth (Synemon plana), the Perunga grasshopper (Perunga ochracea) and several woodland birds.
- The button wrinklewort (Rutidosis leptorrhynchoides), an endangered plant, which occurs in scattered locations in the study area, resulting in possible local constraints.

In order to clarify the nature of major ecological constraints within the study area, the following hierarchy has been used for identifying areas of conservation value:

1. Existing or committed nature reserves. These can be treated as highly significant constraints.

2. Other areas where there is a strong case for inclusion in reserves, including extensions to existing reserves, or alternatively be managed for multiple use in a way which conserves their ecological values. It is recommended that
these also be treated as significant constraints, subject to possible minor refinements. They may include Commonwealth land.

3. Complementary habitat, buffer areas and connecting areas. These areas are constrained but may be partially developed at a relatively low intensity which retains important ecological values.

4. Areas with no major ecological constraints.

Land within the first two levels of this hierarchy can be regarded as core conservation sites, irrespective of their current reserve status, while land within the third level forms complementary conservation sites.

The interactions between areas, particularly in relation to wildlife movement, has also been considered, both at the broad landscape level and in terms of local connectivity within or between sites.

The potential ecological constraints are discussed by dividing the study area into six sections and discussing each of these in turn. A summary of these constraints is presented in Figure S.1. A large proportion of the land which is subject to ecological constraints is used for Defence purposes or for Canberra International Airport.

The main ecological constraints within the study area can be summarised as follows:

- Development within some large parts of the study area is potentially constrained by the presence of the endangered ecological community, natural temperate grassland.

- An even larger area is potentially constrained by the presence of habitat for the endangered grassland earless dragon. Much of this habitat is within the natural temperate grassland, but much of it is within native pasture, while some buffers or connecting areas are located in degraded native pasture or exotic pasture.

- Most of the records or likely habitat for other threatened grassland species are within the above natural temperate grassland/ GED habitat areas and do not impose significant additional constraints. The main exception to this are the scattered occurrences of button wrinklewort, which appear as localised constraints without having major strategic implications.

- Most of the important woodland areas within and around the study area are within proposed nature reserves or the Majura Military Training Area, but there are some other smaller woodland patches which are important as bird habitat or may be strategically important in the functioning of a bird movement corridor through the study area.

There is an outstanding ecological opportunity within the study area to create a series of viable grassland reserves with a view to ensuring the long term survival in the wild of the grassland earless dragon. The significance of this is emphasised by
the strong possibility that, if such action is not taken, the species could become extinct in the wild in the medium (or possibly even short) term.

Because of the large number of threatened species and ecological communities within the study area, development in much of the area is likely to require preparation of environmental impact statements under the ACT Planning and Development Act, and to justify referral under the Commonwealth EPBC Act. In particular, any development with potential to impact on the grassland earless dragon is likely to experience intense scrutiny. This in turn could result in costs and delays for developers. The level of certainty with respect to future development in the study area may be enhanced by developing a holistic approach to biodiversity conservation which provides an agreed context under the EPBC Act for the review of any future developments. It may be feasible to achieve this using the strategic environmental assessment provisions of the Planning and Development Act.
1. INTRODUCTION

The Eastern Broadacre Planning Study (EBPS) is being undertaken by Macroplan Australia on behalf of the ACT Planning and Land Authority (ACTPLA) to investigate the economic potential of the Majura – Symonston – Jerrabomberra area (see Figure 1.1) as a future employment corridor for Canberra, as identified in The Canberra Spatial Plan (Ref. 1). This corridor also contains areas which are of high potential for biodiversity conservation in the ACT, either as nature reserves or as low intensity land uses which would be compatible with biodiversity conservation. Most of these areas contain threatened species or ecological communities which are protected under the Commonwealth Environment Protection and Biodiversity Conservation Act (EPBC Act), as well as the ACT Nature Conservation Act (NC Act).

The Commonwealth and Territory objectives with respect to biodiversity conservation are such that many of the areas of high natural quality are likely to be seen as significant constraints in the future planning of the area. This has direct implications for the economic analysis in that such areas are unlikely to be available for development to their full potential, or would at least generate a high level of uncertainty with respect to their development potential. It is therefore important for such areas to be identified at an early stage in the planning process.

In addition to identifying potential constraints on development, this ecological assessment provides the opportunity to review holistically the opportunities within the corridor for biodiversity conservation. This is not new work but reinforces in a broader context the findings of the threatened species Action Plans that have been prepared by the ACT Government since the mid-1990s (see Section 3.1).

This report has been prepared in consultation with staff of the Research and Planning Unit of Environment and Recreation, within the ACT Government Department of Territory and Municipal Services.

The purpose of this report is to inform members of the study team of the ecological issues relevant to the study area, so that this information can be taken into account in other components of the study. This information is based mainly on the extensive ecological analysis and planning that has been undertaken by or on behalf of the ACT Government in recent years.
2. HISTORICAL BACKGROUND

The conservation of natural areas has been a feature of Canberra's development since the early days of planning for the national capital. Initially, this was driven largely by visual landscape considerations and recreational demands but, in more recent years, biodiversity conservation has also become a major influence. A sequence of actions since the 1970s has seen the systematic documentation of the ecological resources of the ACT (Refs. 2, 3, 4), the identification and assessment of sites of ecological significance (Ref. 5), legislation through the *NC Act* to identify and protect threatened species and ecological communities, and extensive research and monitoring which has led to a comprehensive series of ACT Government Action Plans for the conservation and management of these species and communities in the ACT.

The latter work was well advanced in 1999 when the Commonwealth *EPBC Act* was passed. Among its many provisions, the *EPBC Act* has added a further level of protection to threatened species and ecological communities, as well as migratory species, which are recognised under the Act as matters of national environmental significance.

These actions have been accompanied by changes in the government approach towards biodiversity conservation. Throughout much of Canberra’s development, the land set aside for conservation was predominantly land that was not highly suitable for urban development, for example, being too steep, too elevated for economical servicing, too isolated or floodprone. With hindsight, there were many areas which, by today’s standards, would have been of high value for nature conservation, despite a history of low intensity rural use, but were also prime urban development areas and became used for that purpose.

Over the past twenty years, however, there have been several decisions which have resulted in potentially important development areas being spared from urban development in the interests of biodiversity conservation, for example:

- major expansion of the Mulligans Flat Nature Reserve in Gungahlin from its originally planned boundaries to incorporate additional woodland;
- creation of a small park in prime development land in Barton to protect habitat for the endangered golden sun moth;
- withdrawal of extensive areas of central Gungahlin from development and total redesign of the Gungahlin Town Centre to accommodate three large native grassland reserves; and
- abandoning previous plans to develop about two-thirds of the final development stage of O’Malley, to protect an area of woodland within a nature reserve.

In all of these cases, the land involved was well suited to both urban development and nature conservation, and a value judgement was made in favour of the latter. A large proportion of the land in the EBPS study area similarly has both high development potential and high conservation value, and has the potential to face similar conflicts.
3. AN OVERVIEW OF ECOLOGICAL VALUES

3.1 Introduction

The high ecological value of much of the land within the study area derives partly from its natural attributes and partly from its land use and management history.

The study area contains a large amount of low-lying valley land which was originally natural temperate grassland (Ref. 6). Surrounding this grassland was lowland woodland, much of it dominated by yellow box and Blakely’s red gum. A similar vegetation pattern originally existed in other parts of Canberra and in much of the Southern Tablelands area surrounding the ACT.

In the early days of European settlement, these areas provided the best land for grazing, pasture improvement and cropping. Consequently these vegetation communities became extensively modified and the plant and animal species that they supported declined significantly in numbers. Further intensification of agricultural activities in the twentieth century exacerbated this decline. With the creation of the ACT, however, the change of land tenure from freehold to leasehold and the withdrawal of some land for Commonwealth purposes led to more benign management regimes which retained some of these ecological values before they had declined irreversibly. In those areas which have not been subject to urban development, plantation forestry or other intensive uses, some of the old ecological values remain and have even improved over the last few decades.

The situation in the ACT contrasts with that in most comparable areas of New South Wales where ongoing agricultural uses have prevented ecological recovery. Consequently, a disproportionately large amount of these rare and threatened ecological communities and the flora and fauna that they support is concentrated in the ACT, particularly in the Majura and Jerrabomberra Valleys.

Since the time of self-government, the ACT Government has been proactive in planning for the conservation of its most valuable ecological resources and has been exceptional in undertaking two rounds of Action Plan preparation for its threatened species and ecological communities. The first round, undertaken mainly between 1996 and 1999, addressed these species and communities on an individual basis, resulting in Action Plans 1 to 26. Some of the research on which these Action Plans were based had been ongoing for several years previously.

The second round, undertaken between 2002 and 2007, took a more integrated approach, reflecting the philosophy that threatened species cannot be satisfactorily conserved in isolation from the communities and ecosystems that support them. This second round has resulted in three major Action Plans, the *ACT Lowland Woodland Conservation Strategy* (Action Plan No. 27, Ref. 7), the *ACT Lowland Native Grassland Conservation Strategy* (Action Plan No. 28, Ref. 6) and the *ACT Aquatic Species and Riparian Conservation Strategy* (Action Plan No. 29, Ref. 8). The first two of these Action Plans, together with the research and monitoring on which they are based, have major implications for the EBPS.
These Action Plans identify areas assessed as endangered ecological communities and other types of native woodland or grassland. They also show the locations where threatened species have been recorded and separate information is available also to demonstrate where those species have been searched for without success. However, nature is dynamic and does not operate within rigid boundaries. It is necessary to consider that ecological attributes can change with time, that animals can move between habitat areas on a short term or long term basis, and that plants can also change their observed distribution pattern over time due to seasonal factors and land management changes.

In terms of proactive biodiversity conservation, the ideal approach is to establish a series of conservation reserves which are of sufficient size and diversity to maintain a full range of ecological communities (and hence species) on a long term basis. In addition, it is desirable for such reserves to be located to enable animal movement and other interactions between them. There are many obstacles to this ideal approach, however, including the costs of land withdrawal and of management resources and competition with other land uses. There are other ways, however, in which conservation objectives can be met.

One way is through appropriate management of land which has a primary purpose other than nature conservation. This is the situation with respect to much of the land within the study area, which is currently used for defence purposes, aviation or low intensity rural purposes. Certain styles of industrial or institutional development may also be compatible with this approach. The approach of satisfying both development and conservation objectives to an acceptable degree, but without necessarily achieving either to the ideal extent, was pursued for the Jerrabomberra Valley in the Southern Broadacre Planning Study (Refs. 9, 10).

The ecological values of the study area can be considered under two headings:

- General ecological values
- Ecological values determined by legislation

The latter heading refers to those threatened species and ecological communities and migratory species and their habitat which are protected under the EPBC Act and/or the NC Act. Those known to be directly relevant to the study area are discussed in the following sections.

The general ecological values relate to dry sclerophyll forest, woodlands other than yellow box – red gum, and native grassland which does not meet the criteria for natural temperate grassland (e.g. native pasture). These may also contribute to the habitat used by threatened species but, even if they do not, can still be important for other species on which the ecosystem balance depends, as well as for wildlife movement.

The EPBC Act does not address these general ecological values. They are better reflected in the ACT Government Action Plans, although the latter still have a strong emphasis on threatened species and communities.
A summary of the occurrence and status within the study area of threatened species and ecological communities, as well as other species and communities of ecological value is presented in the following sections.

3.2 Natural Temperate Grassland

Action Plan No. 28 (Ref. 6) assesses the conservation value of native grasslands according to the following hierarchy:

- **Category 1: Core conservation sites.** These sites are typically of high botanical significance, contain key threatened species habitat, and/or are large sites (more than 100 ha), and warrant the highest level of protection. The Action Plan lists nineteen of these sites. Ten of the fifteen largest sites are within the current study area. None of these sites is within a formally declared reserve, although two of the sites in the Jerrabomberra Valley have been surrendered from lease and are being managed as nature reserves pending the required amendments to the Territory Plan.

- **Category 2: Complementary conservation sites.** These sites are of moderate botanical significance, contain habitat for threatened species and/or are medium area site (10-100 ha). Of the 22 sites listed in this category, six are within the study area. In addition, the Jerrabomberra Valley contains habitat which is not native grassland but provides an important habitat buffer for some of the Category 1 sites.

- **Category 3: Landscape and urban sites.** These are sites of low botanical significance, and may contain small populations of threatened species in marginal or fragmented habitat that is not considered to be viable in the medium to long term, but may still be valuable as buffers or connections between higher conservation value sites. There are several such sites in the study area.

Not all of the native grassland identified in Action Plan No. 28 meets the criteria for natural temperate grassland as listed as an endangered ecological community under the *EPBC Act* or the *NC Act*. The Action Plan distinguishes that community from native pasture, degraded native pasture and exotic pasture. Some areas of these other types of grassland, however, may still be of conservation value by providing suitable habitat for threatened species, particularly if they are associated with nearby areas of natural temperate grassland. The presence of natural temperate grassland is therefore not an adequate criterion on its own for assessing grassland ecological values.

The distribution within the study area of natural temperate grassland, other native grassland (pasture) and associated exotic pasture which is of some habitat value is shown in Figure 3.1.

One of the major difficulties facing lowland native grassland conservation is that the areas most suitable for conservation tend to be very valuable for development purposes and there can be an enormous opportunity cost in conserving them at a scale that is ecologically viable. Furthermore, to the untrained eye, they appear to
be very ‘ordinary’ areas due to the lack of trees and other visual diversity, as well as the cryptic and unspectacular nature of many of the species that they are intended to protect. While community appreciation of grasslands may be growing, the rational basis for conserving areas such as the three large grassland reserves in the centre of Gungahlin is not apparent to much of the population.

Because of the costs of acquiring and managing dedicated nature reserves, as well as the alternative demands for the land, much of the thrust of Action Plan No. 28 is directed at conserving native grasslands within other appropriate land uses through a series of Memoranda of Understanding (for Commonwealth land) or land management agreements (with rural lessees). These are effectively mechanisms for formalising the management regimes that have enabled the grasslands to survive to the present time, while similar communities elsewhere have become irreversibly modified through intensive agriculture.

The issue of grassland conservation in the Jerrabomberra Valley does not stop at the ACT border but continues beyond the study area into New South Wales. Here the ecological issues are similar even though the political and land ownership situations are quite different. The brief for the present study requires consideration of cross-border issues and this is important from an ecological perspective as well as from an economic perspective.

3.3 Yellow Box – Red Gum Grassy Woodland

Action Plan No. 27 (Ref. 7) is concerned with all lowland woodland in the ACT, but only that part of the woodland which is dominated by yellow box (Eucalyptus melliodora) and Blakely’s red gum (E. blakelyi) constitutes a listed threatened ecological community under the NC Act or EPBC Act. The EPBC Act has a broader listing described as ‘White box – yellow box – Blakely’s red gum grassy woodlands and derived native grasslands’. The community listed under the NC Act also includes secondary grasslands, which are distinguished in their genesis from natural temperate grasslands through having been originally part of a woodland community.

Action Plan No. 27 distinguishes the following categories of lowland woodland in the ACT:

- **Unmodified lowland woodland.** Such woodland would maintain its pre-1750 composition and structure, but in reality there is little or none of this woodland remaining due to the past impacts of grazing and exotic species invasion.

- **Partially modified lowland woodland.** This comprises relatively intact remnants of the pre-European ecological community, having been subject to only light or infrequent grazing. Some areas of this woodland remain within the study area, particularly in the proposed Callum Brae Nature Reserve. Most of this woodland is classified also as yellow box – red gum grassy woodland in the Action Plan.

- **Moderately modified lowland woodland.** This may resemble partially modified lowland woodland in terms of mature tree cover but has a
significantly lower native component in the understorey, although still sufficient native understorey in yellow box – red gum areas to justify its classification as the listed endangered community under the **NC Act**. The criteria for listing under the **EPBC Act** are more stringent, and some of these areas may not strictly qualify for listing under the Act.

Moderately modified woodland is present in the study area, particularly in and around the proposed Callum Brae Nature Reserve and on the eastern slopes of the Majura Valley, where it is classified predominantly as yellow box – red gum grassy woodland.

- **Moderately modified lowland woodland – secondary grassland.** In this situation, the majority of the trees have been removed and have not regenerated, but the native understorey is relatively intact. There are only small areas of this community within the study area, some of it within the yellow box – red gum grassy woodland community.

- **Substantially modified lowland woodland.** In these areas, there are woodland trees over a highly degraded native understorey, exotic perennial and annual species and areas of bare ground. While these do not fall within the criteria for the listed community under either the **NC Act** or the **EPBC Act**, even if yellow box or red gum is predominant, the tree cover may still provide valuable habitat, particularly for birds. Extensive areas of substantially modified woodland are present in the study area in the upper (northern) part of the Majura Valley and between or adjacent to the better quality woodland in the Callum Brae area and north of Hume.

- **Severely modified lowland woodland – paddock trees.** These trees are the only remnants from past clearing, grazing and cultivation and are scattered throughout former woodland areas. They are not mapped in Action Plan No. 27 but remain in parts of the study area, where their main ecological value lies in providing habitat hollows or local food sources.

The categories of lowland woodland mapped in Action Plan No. 27 are shown in Figure 3.1. Those woodland areas which meet the ACT criteria for the listed yellow box – red gum grassy woodland community are shown by a separate overlay.

In contrast to Action Plan No. 28 for lowland grasslands, Action Plan No. 27 does not specifically identify a hierarchy of core and complementary conservation sites. It is understood that such work is ongoing within Research and Planning, and that the findings of the present study are consistent with that work.

As a general rule, the woodland areas of highest conservation value are likely to be those which have experienced the least modification and are large and contiguous, or connected via native grassland. The presence of the yellow box – red gum community adds a further element of conservation value.

Where remnant woodland areas are present, however, it is necessary also to consider their potential role in facilitating wildlife movement, particularly birds. Studies of woodland birds (Refs. 11, 12) have identified the desirability of
maintaining remnant woodland patches, at least 10 ha in area, at distances of no more than 1.5 km along bird movement corridors. Action Plan No. 27 identifies major wildlife movement corridors running north – south along both sides of the study area, utilising the woodland habitat. While this is a very broad assessment, it points to the need to consider carefully in this context any sizeable stands of woodland trees within the study area. The requirements for wildlife movement are discussed further in Chapter 4.

3.4 Riparian Zone Communities

Action Plan No. 29 (Ref. 8) presents the ACT aquatic species and riparian zone conservation strategy, for the main rivers in the ACT, including the Molonglo River which crosses the study area. In contrast to the terrestrial ecological resources of the study area, the ecological values of the section of the Molonglo River within the study area are exceptionally low.

Willows and other weed species dominate most of the riverine environment between the Molonglo Gorge and Lake Burley Griffin. The water quality in the river is poor and macroinvertebrate sampling indicates severely impaired stream condition. This situation favours introduced fish rather than native species, and there is a full complement of alien fish species present.

While there is potential to manage the river and its corridor to improve its ecological values, its current condition indicates that there are no ecological attributes which are likely to prove a constraint to responsible development. On the other hand, there may be development opportunities within the corridor which could lead to enhancement of its ecological values, and its connectivity with terrestrial habitat corridors.

The main aquatic ecological asset relevant to the study area is the Jerrabomberra Wetland Nature Reserve which includes the lower reaches of Jerrabomberra Creek and an associated series of old drainage ditches on the Molonglo River floodplain, adjacent to the western edge of the study area. While the nature reserve boundary and management plan (Ref. 13) protect the wetlands from direct disturbance, the indirect impacts on the wetlands and its use by people are a consideration in the development of both adjacent land and other land within the catchment which could impact on water quality in the creek.

3.5 Grassland Earless Dragon

Existing populations of the grassland earless dragon (GED, *Tympanocryptis pinguicolla*) have been confirmed only within the study area, together with a more limited area of adjacent land in New South Wales, and in grassland sites near Cooma (Refs. 6, 25). Genetic studies have suggested that the ACT and Cooma populations may differ to the extent that they constitute two separate subspecies (Ref. 26), in which case the study area, together with adjacent New South Wales land, would contain the only currently known habitat for one of these subspecies. There has been some conjecture on scientific circles on this point but, irrespective of the eventual outcome of this scientific debate, the habitat in the Majura and
Jerrabomberra Valley is of high priority nationally for the survival of the GED in the wild.

The team responsible for the April 2000 National Recovery Plan for the GED (Ref. 25) considered development at sites known to support populations of the GED to be inappropriate until a national system of reserves and managed areas is established to fulfil the primary objective of that recovery plan, namely to ensure the ability of the GED to flourish and maintain its potential for evolutionary development in the wild, across its natural geographic range.

The GED has been surveyed extensively in the study area (as well as in other ACT grasslands) since the early 1990s and its recent distribution is well documented. It occurs through much of the natural temperate grassland in the Majura and Jerrabomberra Valleys as well as in some adjacent areas of native and even exotic pasture (see Figure 3.2), but it is localised to these areas. Consideration of its habitat protection, as well as potential movement corridors between known habitat areas, had a major influence on the recommendations of the Southern Broadacre Planning Study (Refs. 9, 10), and on the decision by the ACT Government to propose two nature reserves in the Jerrabomberra Valley.

The dedication of these nature reserves is not regarded as an adequate measure in its own right for the conservation of the GED. It is necessary also to maintain supplementary habitat and connectivity on surrounding suitable managed land, as has occurred to date. This would potentially place major constraints on the nature and extent of other development in large and strategically located parts of the Majura and Jerrabomberra Valleys, although some of these areas are constrained for other reasons such as airport or defence use.

Monitoring in recent years has indicated that sympathetic land uses on their own many not be adequate for maintaining GED populations. Over the past three years, the population size in the Majura Valley appears to have dropped significantly, while numbers in the prime habitat in the Callum Brae Nature Reserve have also dropped in the past year (Ref. 15). This may be a seasonal fluctuation resulting from the sequence of dry years. In the case of Majura, some scientists have blamed it on the overgrazing caused by uncontrolled kangaroo populations. That issue is the subject of a current ACT Government inquiry.

While there are many threatened species known within the study area, the GED is the only one which is not known to occur also in other parts of the ACT. Furthermore, the local population may constitute a subspecies that is not found elsewhere in other regions of Australia. It is therefore likely to be the most decisive of these species in constraining development within the study area.

3.6 Striped Legless Lizard

The striped legless lizard (SLL, Delma impar) is found in some parts of the Majura Valley and the Jerrabomberra Valley, sometimes in the same habitat as the GED and sometimes in different (but usually adjacent) areas (see Figure 3.3). Unlike the GED, it is not confined to the study area but is present in three large nature reserves in Gungahlin, as well as other areas in Gungahlin, East Belconnen and Central...
Canberra (Ref. 6). It is also found in native grassland in other parts of Australia, and is listed as vulnerable rather than endangered under the NC Act and EPBC Act.

While protection of SLL habitat is desirable from the broad perspective of grassland ecosystem conservation, this is unlikely to receive the same priority as protection of GED habitat. Instead, it is more appropriate to address it in the context of other grassland values.

3.7 Pink-tailed Worm Lizard

The pink-tailed worm lizard (*Aprasia parapulchella*) has recently been listed as vulnerable under the NC Act, and is listed as vulnerable also under the EPBC Act and the New South Wales Threatened Species Conservation Act (TSC Act).

In the ACT it has been widely recorded along the Murrumbidgee and Lower Molonglo River valleys, as well as on some hill areas, particularly Mount Taylor. Within the study area, it has been recorded in one area within Callum Brae Nature Reserve (see Figure 3.3). While its greatest recorded concentration is in the ACT, it has been found in other regions in New South Wales, as well as in Victoria.

Because of its apparently limited distribution within the study area, it is unlikely to be a constraint on development in the current study.

3.8 Golden Sun Moth

The golden sun moth (GSM, *Synemon plana*) has a scattered distribution throughout the Canberra area, being recorded at a steadily increasing number of sites and in a growing diversity of grassland habitats. It appears capable of surviving, albeit in low numbers, in relatively small and isolated sites within urban areas, as well as in larger areas of native grassland habitat.

It was listed as endangered under the NC Act and critically endangered under the EPBC Act at a time when the number and range of records was significantly less than at present.

Action Plan No. 28 records it in the lower Majura Valley around and north of the airport, as well as near Campbell Park Offices, as well as at two sites (both within proposed nature reserves) in the ACT part of the Jerrabomberra Valley (see Figure 3.3). It is also found just across the border in New South Wales.

Based on current records, the GSM appears unlikely to present a significant constraint on development with Territory land within the study area, as most of the recorded distribution is within Commonwealth land or proposed nature reserves.

3.9 Perunga Grasshopper

The perunga grasshopper (*Perunga ochracea*) is listed as vulnerable under the NC Act but is not listed as threatened under the EPBC Act. It has a scattered distribution in the ACT, with only a small number of records, including some in the Majura and Jerrabomberra Valleys (see Figure 3.3). Most of these records have
been from areas with other significant grassland values (e.g. natural temperate grassland or GED habitat).

Based on current records, the perunga grasshopper appears unlikely to present an additional constraint on development within the study area.

3.10 Woodland Birds

There are several woodland birds which can occur in the ACT and which are listed as threatened under the NC Act and/or the EPBC Act. These include the following:

- Regent honeyeater (*Xanthomyza phyrgia*). Listed as endangered under the NC Act and the EPBC Act.
- Brown treecreeper (*Climacteris picumnus*). Listed as vulnerable under the NC Act, not listed under the EPBC Act.
- White-winger triller (*Lalage sueurii*). Listed as vulnerable under the NC Act, not listed under the EPBC Act.
- Hooded robin (*Melanodryas cucullata*). Listed as vulnerable under the NC Act, not listed under the EPBC Act.
- Varied sittella (*Daphoenositta chrysoptera*). Listed as vulnerable under the NC Act, not listed under the EPBC Act.
- Superb parrot (*Polytelis swainsonii*). Listed as vulnerable under the NC Act and the EPBC Act.
- Swift parrot (*Lathamus discolor*). Listed as vulnerable under the NC Act and endangered under the EPBC Act.
- Painted honeyeater (*Grantiella picta*). Listed as vulnerable under the NC Act, not listed under the EPBC Act.

In addition, the diamond firetail (*Stagonopleura guttata*), which is listed as vulnerable under the NSW Threatened Species Conservation Act (Ref. 16), has been nominated for listing under the NC Act.

Records of the Canberra Ornithologists Group (COG, Ref. 17) indicate that the white-winged triller, the varied sittella and the diamond firetail have the potential to be found in the woodland throughout and adjacent to much of the study area. The brown treecreeper and the hooded robin have been recorded as present in woodland in the Mount Ainslie/ Campbell Park area at the southern edge of the Majura Valley. The Campbell Park area is regarded as an area of high woodland bird diversity (Ref. 1).

An area of woodland near Newline quarry, south of Pialligo Avenue (see Figure 3.3) is reported to be one of the best remaining patches of habitat for the brown treecreeper (Ref. 18). That area also used to be occupied by the hooded robin, but this is no longer the case (Ref. 18). The hooded robin and the brown treecreeper are birds which require relatively large areas of woodland to maintain viable long-term populations.
While the painted honeyeater was recorded in the Mugga Lane and ‘Woden’ property areas in the south of the study area during an influx of the species to the ACT in spring/summer of 2002-03, it is not found regularly in the ACT. The regent honeyeater is also rarely seen in the ACT, which is at the upper altitudinal limit of its range. All reports of this species in the ACT have been north of the Molonglo River (Refs. 7, 17), and it may use woodland in the Majura Valley on rare occasions, and has been recorded near Newline quarry (Ref. 18).

The superb parrot has been recorded mainly in the Hall area (Ref. 6), while the swift parrot is a rare winter migrant to the ACT. These parrot species are unlikely to utilise the study area.

In addition, there are several other woodland bird species which are reported to be declining in numbers, and which may be found within or around the study area.

While there are no specific sites within the study area which are known to be critical for any of the above bird species, the larger and more diverse woodland areas, such as the Campbell Park area (on the edge of the study area) and the Callum Brae woodland, are likely to be important in the broad picture of woodland bird conservation (see Figure 3.3). In addition, smaller woodland patches (desirably 10 ha or more) at regular intervals (say 1.5 km) have been assessed as being important in facilitating the movement of woodland birds (Refs. 11, 12). Where such patches are absent, corridors of tree cover (e.g. along roads), small patches or even isolated trees may be useful in maintaining bird movement corridors.

### 3.11 Button Wrinklewort

The button wrinklewort (*Rutidosis leptorrhynchoides*) is listed as endangered under both the *NC Act* and the *EPBC Act* and has been a ‘flagship’ species among threatened plants in the ACT since the late 1970s, when scientific concerns were raised about its protection at Stirling Park Ridge and Attunga Point in Yarralumla. Since then, it has been found at an increasing number of sites in natural temperate grassland or on the grassland-woodland ecotone. Several of these sites are located within the Majura and Jerrabomberra Valleys, including some sites in New South Wales (see Figure 3.3 for ACT sites).

Most of the sites in the ACT where the button wrinklewort is present are not located in conservation reserves, and some are not in areas mapped in Action Plan No. 28 as natural temperate grassland. Consequently, this species depends on appropriate management within sympathetic land uses for its long term survival. Where it is present in the study area, it is likely to be regarded as a potential local constraint on development.

### 3.12 Small Purple Pea

The small purple pea (*Swainsona recta*) is listed as endangered under both the *NC Act* and the *EPBC Act*. There are very few records of it in the ACT and none within the study area, although a single plant was recorded in the 1980s along Long Gully Road just outside the south-western edge of the study area.
Where present, it does not shoot or flower every year, reducing the chances of detecting it, even if it is present but dormant. Based on its known distribution, it is unlikely to be a constraint within the study area.

3.13 Hoary Sunray

The hoary sunray (*Leucochrysum albicans* var. *tricolor*) is listed as endangered under the *EPBC Act*, reflecting its status in Tasmania, but this listing appears to be anomalous as it can occur in large numbers in some areas within and surrounding the ACT. Furthermore, it colonises disturbed sites, such as road edges and drainage ditches. It is not listed under the *NC Act*.

There are large populations of the hoary sunray on the lower south-eastern slopes of Mount Ainslie as well as on the western slopes of Mount Majura. There is the prospect that it could spread into some parts of the study area in the Majura Valley in the absence of regular grazing.

Because it occurs so extensively within nearby ACT nature reserves, it is unlikely that any other records within the Majura Valley would be considered a significant constraint on development.

3.14 Other Grassland and Woodland Plants

Action Plans 27 and 28 list a number of other threatened or uncommon plants which may be found respectively within lowland grassland or woodland areas. Within the study area there are no records of any of these being likely to constitute a constraint on development. This, however, does not preclude the possibility of significant populations of such plants being found in the course of more exhaustive studies.

3.15 Latham’s Snipe

Latham’s snipe (*Gallinago hardwickii*) is a migratory bird which moves annually between Asia and southern Australia. Its migratory habitat is protected under international treaties with Japan and China and consequently it is listed as a migratory species under the *EPBC Act*.

There are several sites within the ACT which are used by Latham’s snipe on a seasonal basis. These include parts of the Jerrabomberra Wetlands Nature Reserve, adjacent to the study area, and a site in the Harman naval precinct within the study area (see Figure 3.3). If there are any other sites within the study area that can develop seasonally wet tall grassland, these may also be considered as potential habitat, although, based on current knowledge of the snipe in the ACT, they would be unlikely to be significant constraints.

The conservation of Latham’s snipe habitat is not specifically addressed in any of the ACT Government Action Plans, as Latham’s snipe is not a threatened species.
3.16 Other Animals

There are many other animals which do not have threatened species status which are present within the woodland and grassland of the study area. Some of these may be important in relation to the general ecosystem processes which influence the survival of threatened species.

One of the most conspicuous of these species is the eastern grey kangaroo which has adapted well to the post-European landscape and has proliferated in such high numbers in the ACT that it is now considered by some scientists to be a significant threat to the integrity of some native grassland areas and potentially the survival of threatened grassland species. This concern has been raised particularly in relation to GED habitat on Defence land in the Majura Valley.

Feral animals, such as rabbits, hares, foxes and some birds, are also of concern in relation to ecosystem stability, and may be of consideration in relation to land use or management changes. Where relevant, the implications for feral animal populations would need to be considered in relation to specific development proposals.

Another specific issue in relation to the study area is the safety implications for Canberra International Airport of habitat changes which could increase the risk of bird strike along aircraft flight paths. This has been raised in the past as a particular concern in relation to large, soaring waterbirds such as pelicans and cormorants, and is a consideration in proposals for any major water features within the study area. The effects on population sizes and movement paths of other birds may also be of concern in relation to changes in vegetation and landscaping generally in areas close to the airport.

3.17 Other Plants

Some trees in the study area, such as the Pialligo Redwoods, may be seen as constraints because of their cultural heritage values, rather than for ecological reasons.

Trees planted in grassland areas may conflict with the natural values of these areas, and facilitate predation by birds on small grassland fauna, including several threatened species. A specific threat to native grasslands arises from the spread of aggressive exotic grasses and weeds from adjacent land. This is one reason for maintaining buffer areas around core grassland habitat. This threat can arise in situations where it is necessary to cross grasslands with roads, access tracks or service corridors associated with development in areas beyond the grassland.
4. METHODOLOGY FOR EVALUATING ECOLOGICAL OPPORTUNITIES AND CONSTRAINTS

For the present study, in order to clarify the nature of major ecological constraints within the study area, the following hierarchy is proposed for identifying areas of conservation value:

1. Existing or committed nature reserves. These can be treated as highly significant constraints.

2. Other areas where there is a strong case for inclusion in reserves, including extensions to existing reserves, or alternatively be managed for multiple use in a way which conserves their ecological values. It is recommended that these also be treated as significant constraints, subject to possible minor refinements. They may include Commonwealth land.

3. Complementary habitat, buffer areas and connecting areas. These areas are constrained but may be partially developed at a relatively low intensity which retains important ecological values, or may be otherwise conserved within a sympathetic land use.

4. Areas with no major ecological constraints.

Land within the first two levels of this hierarchy can be regarded as core conservation sites in terms of the biodiversity strategy being development by Research and Planning (cf. Action Plan No. 28, Ref. 6), while land within the third level forms complementary conservation sites.

Some of the complementary conservation sites may be of relatively low natural quality compared with the core sites, and may not maintain animal or plant populations on such a regular basis. They are still important, however, because they provide areas into which populations of threatened species can expand during favourable conditions, even though these populations may contract again during less favourable periods. Potential habitat availability may therefore be a better indicator of the value of such areas than the demonstrated presence of the threatened species themselves, which may require several years of monitoring under a range of conditions to yield meaningful results. Even if a small proportion of such habitat is developed, the remainder may still serve a useful ecological function.

Within each level of the hierarchy, there is a further gradation in terms of relative conservation value. For example, within Level 2, some areas have a very strong case supporting their inclusion as formal nature reserves, while others may be more appropriately managed under an alternative but nevertheless benign form of land management. In the case of the complementary conservation sites (Level 3), the extent to which partial development may be compatible with retention of their important ecological values would need to be determined on a case-by-case basis, balancing conservation priorities against development priorities.

Where no major ecological constraints are identified, this may mean no ecological constraints at all. In some cases, however, there may still be the possibility of
specific local features which warrant protection for their ecological values, such as mature trees or tree stands, small sites containing threatened plants, or small areas containing specialised (e.g. rocky, wet) habitat. Such issues can be addressed at the detailed planning or design level without unduly restricting the general use of the land.

It is important also to consider the potential interactions between areas, particularly in relation to wildlife movement. Such movement needs to be considered at two scales, namely broad landscape level corridors for wildlife movement and local connectivity within or between sites.

The broad woodland corridors within and around the ACT are identified in Figure 6.1 of Action Plan No. 27 (Ref. 7), and are reflected also in the presented study (see Figure 4.1). These relate, for example, to the daily or seasonal movement of more mobile species such as kangaroos and some woodland birds. Such corridors no not necessarily have to be continuous, but may rely partly on ‘islands’ of suitable habitat, as discussed in relation to woodland birds in Section 3.10.

Local connectivity within sites or between adjacent sites (see Figure 4.1) may be important for less mobile species (e.g. GED, SL, GSM) for two reasons. One is for maintaining genetic diversity within populations that otherwise might become isolated. This requires only the occasional movement of an individual between the separate populations, which may occur through a chance event despite the presence of barriers such as roads, which would prevent the regular movement of such species.

The other reason is to repopulate an area which may have been subject to population loss through, for example, a fire, inappropriate land management (e.g. ploughing, spraying), predation or extreme seasonal conditions. Repopulation to a genetically viable level requires the movement of a large number of individuals, which is unlikely to occur through chance events if there is a significant barrier to normal movement.

The types of barriers that may impact on local connectivity include roads and drainage ditches, as well as natural barriers such as permanent creeks. The potential for such barriers to be ecological constraints is reviewed in this study where relevant.

In designating areas for conservation purposes and considering movement corridors and local connectivity, it is important also to consider potential interactions with conservation reserves and other significant habitat across the border in New South Wales. Such interactions are discussed in relation to those parts of the study area adjacent to the New South Wales border.
5. REVIEW OF STUDY AREA BY SECTION

5.1 Introduction

In the reviewing the potential ecological constraints within the study area, it is convenient to divide the area into sections according to the ecological characteristics and potential issues. For this purpose, the following sections are identified (see Figure 5.1):

Section A. Upper Majura Valley. In this section, the valley floor originally supported yellow box – red gum grassy woodland, remnants of which are still evident.

Section B. Lower Majura Valley. In this section, the valley floor originally supported natural temperate grassland, with woodland on the surrounding lower slopes.

Section C. Fyshwick-Pialligo area. This section includes the floodplain of the Molonglo River and adjacent slopes. For convenience, the northern limit of this area is identified as Pialligo Avenue and the southern limit as Canberra Avenue.

Section D. Jerrabomberra Valley, eastern part. This section is located east of the Monaro Highway and includes Jerrabomberra Creek.

Section E. Jerrabomberra Valley, western part – ‘Callum Brae’ hills. This section is located between the Monaro Highway and Mugga Lane.

Section F. South-west Hume. This is a small section at the southern end of the study area.

The main ecological characteristics of each of these areas and the potential ecological constraints that they present for development are discussed in the following sections, using the hierarchy of constraints identified in Chapter 4.

This information is based primarily on Action Plans 27 and 28 and the background studies undertaken for these Action Plans, but also utilises some other more recent information where available.

5.2 Section A – Upper Majura Valley

The upper Majura Valley contains extensive areas of the endangered ecological community, yellow box – red gum grassy woodland, most of which is in a moderately modified condition. The remaining woodland tends to be located mainly on the gentle footslopes directly above the valley floor. Much of it lies within the Majura Training Area (MTA), with some of it within the gun clubs precinct immediately south of the Federal Highway or on steeper land adjacent to the Mount Majura Nature Reserve and extending into the nature reserve, which is on the edge of the study area. Some patches of this woodland community have lost most of their trees, but retain a predominantly native understorey and are classified as secondary native
grassland, which forms part of the woodland community listed under ACT and Commonwealth legislation.

In the lower (southern) part of this section, the remnant woodland is classified as substantially and severely modified, and consists of scattered old trees with a predominantly exotic groundcover. This does not form part of the listed woodland community, but the trees, either individually or in clumps may be ecologically valuable as animal habitat, providing nesting hollows, as well as food for some species.

The threatened status of the woodland means that it is a potential constraint on development where it remains in a reasonable condition. The scattered nature of the woodland patches makes it difficult to establish an obvious boundary around this area, however. Should this part of the valley be developed, some rationalisation of development/conservation boundaries is likely to be required. There is probably potential for additional areas which are currently not classified as woodland to regenerate if they are given the opportunity.

In the substantially and severely modified areas of woodland to the south, constraints on development are likely to be limited to the protection of individual trees or tree clumps. Apart from their ecological values, many of these trees may be considered important also from a landscape perspective and would be subject to the Tree Protection Act if they were located on leased urban land. This may constrain block layout or utilisation of land within affected blocks, but would not be a major constraint on development.

A further important consideration in relation to land in the northern part of the Majura Valley is its role as a major woodland corridor for wildlife movement (Ref. 6, see Figure 4.1). From the woodland areas bordering Gungahlin, this corridor branches at the Federal Highway, with the western arm connecting with nature reserves on Mount Majura and Mount Ainslie, and the eastern arm connecting with woodland and forest in the MTA, with further connections to the forest on the Kowen Escarpment and in the Goorooyarroo Nature Reserve in New South Wales. (This is distinct from the Goorooyarroo Nature Reserve in Gungahlin). From the Kowen Escarpment, there are further connections via Molonglo Gorge to extensive forest areas east and south of Queanbeyan. In addition to its value as an endangered ecological community, protection of the woodland for continuity of wildlife movement is likely to be significant constraint in this section, particularly in the area immediately south of the Federal Highway.

Indicative boundaries showing the conservation priorities and hence the extent of ecological constraints are shown in Figure 5.2. These boundaries have been generalised and would be subject to more detailed assessment in the event of future development taking place. Some steep slopes on the eastern side of Mount Majura which are currently used for pine plantation have been included, based on the assumption that such use would not continue in the event of development of the rest of the plantation area.
5.3 Section B – Lower Majura Valley

The outstanding ecological attribute of the lower Majura Valley is its extensive areas of natural temperate grassland and native pasture. In addition to natural temperate grassland being an endangered ecological community, these areas support relatively large populations of the endangered species, grassland earless dragon and golden sun moth, as well as the vulnerable species, striped legless lizard and several other more limited occurrences of other threatened plants and animals (e.g. button wrinklewort, perunga grasshopper). Along with similarly diverse areas in the Jerrabomberra Valley, this area is one of the most significant areas in the ACT for threatened species conservation.

The most significant attributes of the area are concentrated in two locations (see Figure 5.2). One is within Canberra International Airport and part of the MTA immediately to the north of the airport. The other is on the eastern edge of the Mount Ainslie Nature Reserve.

The most significant ecological attribute of both of these areas is the presence of the GED, which is otherwise found locally only in the Jerrabomberra Valley (see Section 3.5). This would justify an highly significant constraint on intensive development in both areas except where this is impracticable because of existing land use commitments such as the airport and associated facilities. The other biodiversity attributes of the land reinforce this assessment.

That constraint applies not only to land development but also to potential roads through the area (e.g. for access to Kowen, or for northern access to the airport). A major road through this area would probably create a significant barrier to GED movement and has the potential to fragment the GED population, isolating the population in less favourable habitat within the airport and inhibiting replenishment should that population decline under unfavourable conditions. Any major development in this area is likely to justify extensive environmental assessment under both the ACT Planning and Development Act and the Commonwealth EPBC Act.

Much of the native grassland and GED habitat is of a quality that would justify its inclusion in nature reserves specifically managed for their biodiversity values. Implementation of such a step, however, is influenced by the fact that the majority of the land is under Commonwealth control and is not available to the ACT Government. The main potential for an additional nature reserve area under ACT Government control is an area of GED habitat/native pasture adjacent to the Mount Ainslie Nature Reserve. Expansion of that nature reserve to include the adjacent grassland would have the particular benefit of incorporating both woodland and grassland (and the ecotone along their mutual boundary) into a single reserve, providing an enhanced level of biodiversity.

It is desirable for the GED habitat areas under Commonwealth control to be managed with high priority on their biodiversity values, even if they are not formal reserves.
There are also areas of yellow box – red gum grassy woodland in this section of the study area, which may be constraints in their own right as well as for their contribution to wildlife movement corridors down either side of the valley. One small patch is located immediately east of Northcott Drive, while some more extensive areas are located east of the airport. The latter include a large area of remnant trees which lack the native groundcover required for classification as the endangered woodland community. The woodland to the east of the airport, which is largely within the MTA, is part of a significant wildlife movement corridor connecting Gungahlin with the Molonglo River.

It would be desirable to maintain ecological linkages across the lower Majura Valley connecting the grassland and woodland in the MTA with similar communities in the Mount Ainslie Nature Reserve. The optimum location for such a linkage appears to be through improved pasture which has been identified as SLL habitat, opposite the northern end of the airport. Maintaining such a linkage would constrain development in at least part of this area. Apart from its role as a habitat linkage, the importance of retaining this area as SLL habitat is not as critical as in the case of the GED habitat areas. The SLL is vulnerable only, not endangered, is well conserved in large grassland reserves in Gungahlin, and is present also in the GED habitat in the MTA.

In practice, however, the linking of the two areas either side of the valley may not be readily achievable just by retaining the land under sustainable management. The ability of the GED to cross obstacles such as roads or drainage ditches is uncertain. With the Majura Parkway and potentially the Very High Speed Train (VHST) planned through this corridor, in addition to the existing Majura Road, these are likely to be significant barriers to GED movement. Woolshed Creek may also be a natural barrier to such movement. A movement corridor across the valley may nevertheless be valuable for other more mobile species, which are not unduly impeded by such barriers.

Indicative boundaries showing the conservation priorities and ecological constraints in this section are shown in Figure 5.2. While the precise boundaries may have a little flexibility, it is desirable that grassland areas in particular are not fragmented by development or by associated roads.

5.4 Section C – Fyshwick-Pialligo Area

As the Fyshwick-Pialligo area is a relatively small area and has been substantially modified by past development, there are relatively few ecological constraints in this area. There is a small patch of natural temperate grassland adjacent to Townsville Street which contains a population of the endangered button wrinklewort (Refs. 6, 19). The band of woodland or scattered woodland trees east of the airport extends across Pialligo Avenue towards the Molonglo River, contributing to the wildlife movement corridor, particularly for bird movement. The northern part of this area near Newline quarry is regarded by the Canberra Ornithologists Group as a particularly rich habitat area for woodland birds (Ref. 18, see also Section 3.10). While the existing habitat quality is lower, there is potential for rehabilitating the southern part of this area to improve the habitat link to the Molonglo River.
There are some old woodland trees also within the proposed Griffin Green development north of Canberra Avenue as well as some secondary grassland along Canberra Avenue to the west of that area. These are likely to be only moderate constraints on development.

5.5 Section D – Jerrabomberra Valley, eastern part

The ecological constraints in the Jerrabomberra Valley were addressed in detail in the ecological assessment undertaken for the Southern Broadacre Planning Study (SBPS, Ref. 10), and the findings of that study are generally applicable to the EBPS (see Section 5.8 for further discussion). The recommended conservation options arising from that study are shown in Figure 5.3. The SBPS ecological assessment was influenced particularly by the conservation requirements for the GED, with that species recorded in five sites (some quite extensive) within the valley. Three of those sites are within the eastern part of the valley, and two are within the western part (Section E).

The largest of these sites in terms of area is located in natural temperate grassland and native pasture east of Jerrabomberra Creek. Much of this is on Commonwealth land within the Bonshaw naval receiving station precinct. The southern part of the area, on Territory land centred on Mike’s Hill, has been surrendered from rural lease pending its formal declaration under the Territory Plan as a nature reserve. Much of the remaining part of this site was also identified as potential nature reserve, as was some land between the site and the New South Wales border, which has not previously been classified as GED habitat but appeared to have potential for rehabilitation as such in the longer term. That land, located under the airport flight path, is close to grassland reserves in New South Wales, being separated only by a rural road and the railway.

The original mapping of GED habitat in this part of the Jerrabomberra Valley (Refs. 20, 21) made provision for a buffer area of about 200 metres around known habitat. While provision of such a buffer was not specifically carried through to the SBPS land use recommendations, that issue is likely to arise in future environmental assessments of any proposed development. Such a buffer may be consistent with a low intensity land use involving limited development, but not with intensive industrial or institutional development. It is therefore a significant constraint on future development within such areas.

Based on historical records, ecological assessment made the SBPS made a similar assessment with respect to the two smaller GED habitat areas in Section D. These are located on the Amtech site north of Hindmarsh Drive and the Cookanalla site, south of Hindmarsh Drive and Canberra Avenue, between the Amtech site and the Bonshaw site. Any development within these areas was seen also as being of a low intensity nature, consistent with maintaining the majority of these areas as GED habitat.

All of these sites have biodiversity values beyond that of GED habitat. The Amtech site and parts of the Bonshaw site have been classified as natural temperate grassland, with most of the remainder of the three sites being native pasture. The SLL, perunga grasshopper, button wrinklewort and GSM have all been recorded at
one or near some of the sites, and there is potential for them to be more widely spread within these areas. The button wrinklewort has been recorded also at sites outside the mapped grassland, particularly within the HMAS Harman precinct.

The Amtech site is separated from the Cookanalla site by Hindmarsh Drive, which is likely to form a significant barrier to GED movement. A recent survey for the GED undertaken at the Amtech site in summer 2007-08 found no evidence of the GED remaining on this site. The loss of this GED population may be a result of ongoing drought conditions in recent years, as the habitat characteristics remain suitable for the species. The prospect of the area being repopulated naturally under more favourable conditions are not favourable due to the likely barrier effect of Hindmarsh Drive. While the Amtech site may no longer be considered as GED habitat, it retains other native grassland values, hence is still of potential value as complementary habitat.

There is currently no strong physical barrier, such as a road, between the Cookanalla and Bonshaw sites, and it is desirable to retain a potential habitat link between those areas. This has the potential to be a further constraint on development in this area.

It is desirable also to maintain a habitat corridor between the proposed Mike’s Hill Nature Reserve and the southern part of the proposed Callum Brae Nature Reserve in Section E. Such a corridor appears feasible within the ACT Prison site, subject to appropriate management of the prison surrounds. In this event, no additional constraints should be needed to ensure such habitat continuity. The Monaro Highway, however, would still present a significant obstacle for some species, including the GED, and Jerrabomberra Creek is also a potential barrier.

A further potential constraint in Section D is a wetland south of Canberra Avenue adjacent to HMAS Harman which has been found to be used as habitat by Latham’s Snipe (Gallinago hardwickii), a migratory bird which is subject to international treaties with Japan and China. Protection of snipe habitat is subject to the provisions of the Commonwealth EPBC Act.

It would be desirable to retain this wetland although this need not constrain development nearby, as the snipe is known to frequent areas within industrial estates, provided that they are not subject to human disturbance (Ref. 22). Alternatively, if it were not possible to retain the wetland, this would be unlikely to have a significant effect on snipe migration, due to the presence of other suitable habitat areas in Canberra and the surrounding region.

Considering all of the potential ecological constraints in Section D, there is relatively little unconstrained land east of Jerrabomberra Creek (see Figure 5.2). Some of this land which contains complementary habitat may be developable at a relatively low intensity, but that form of development may not be suitable for most types of industrial uses. The land between Jerrabomberra Creek and the Monaro Highway, however, other than that associated with the ACT Prison, is not subject to any significant ecological constraints.
5.6 Section E – Jerrabomberra Valley, western part – ‘Callum Brae’ hills

The western part of the Jerrabomberra Valley was also included in the SBPS ecological assessment (Ref. 10), with the recommended conservation options for this area shown in Figure 5.3. This assessment has been reviewed in the light of more recent information, as discussed further in Section 5.8.

The natural temperate grassland in the Jerrabomberra Valley extends for some distance west of the Monaro Highway and connects with an extensive area of yellow box – red gum grassy woodland on the slopes of the hills within and around the ‘Callum Brae’ property. The grassland is of relatively high quality in the southern part of this area but is reduced to native pasture in the northern part, due to the low level of native forbs. The woodland is of variable quality, with the better quality woodland in the northern and southern parts of the range of hills, and the central section being substantially modified.

Most of the natural temperate grassland and native pasture has been identified as habitat for GED, for which two main breeding areas have previously been identified (Refs. 20, 21). The larger area in the south (West Jerrabomberra) includes the natural temperate grassland area, while the smaller one in the north (Callum Brae North) is located in native pasture. Part of the northern area (approximately 18 percent) has been identified for development as a long stay caravan park under the ACT Government land swap arrangement for the Narrabundah Long Stay Caravan Park. The native pasture connecting these two areas is important from the viewpoint of maintaining habitat connectivity and has potential for rehabilitation as future habitat.

Other threatened species recorded in the natural temperate grassland in the south and the golden sun moth and the perunga grasshopper. The pink-tailed worm lizard (Aprasia parapulchella) has been recorded in woodland near the southern end of the hills. The Callum Brae woodlands are important as habitat for a range of woodland birds, including some threatened or near-threatened species.

The grassland and woodland areas of highest ecological quality have been surrendered from grazing pending their formal designation as a nature reserve under the Territory Plan. Most of the remaining grassland area is known or potential habitat for the GED. Any further development in this area should desirably be limited in extent, in keeping with the Southern Broadacre Planning Study (see Figure 5.3).

The only substantial area of undeveloped land within this section that is not likely to be subject to significant ecological constraints is on the north-western side of the Monaro Highway opposite the Hume Industrial Estate. While there are some patches of yellow box – red gum grassy woodland (including secondary grassland) and other mature trees in this area, these are of relatively low importance compared with the large woodland areas within the proposed nature reserve, and may be regarded as only local constraints on subdivision design.

Between Narrabundah Lane and Hindmarsh Drive, there is a Special Purpose Reserve on the ‘Mugga Mugga’ property which contains native grassland. This is the only ecological constraint in that part of Section E.
In summary, it would be prudent to regard most of the woodland and grassland south of Narrabundah Lane, with the exception of the area immediately opposite the Hume Industrial Estate, as subject to ecological constraints.

5.7 Section F – South-west Hume

Most of the area in South-west Hume has recently been reviewed in detail on behalf of the Land Development Agency (Ref. 23). This study confirmed the presence of several patches of yellow box – red gum grassy woodland that had previously been identified in Action Plan No. 27. The largest of these areas (approx. 15 ha, see Figure 5.2) is not of high quality due to a high component of exotic grasses and weeds, but may be important strategically for woodland bird movement. It forms an isolated patch of moderately dense tree cover with some limited native understorey within an area which is otherwise substantially modified by rural or industrial uses. This patch is approximately 1.5 km from several surrounding areas of woodland bird habitat. The size of the patch and the distance from other woodland are consistent with the desirable criteria for providing habitat to facilitate woodland bird movement in the Canberra region (Refs. 11, 12). For this reason, it would be desirable to retain the majority of this habitat. It is marginal whether the woodland is of suitable quality to be considered part of the endangered box – gum grassy woodland community under EPBC Act criteria.

The other woodland patches in Section F are small, but provide existing or potential linkages with plantings along the New South Wales border. They are likely to present only minor constraints at the subdivision design level. Most of this section would therefore not be subject to significant ecological constraints.

5.8 Comparison with Southern Broadacre Planning Study

The analysis of ecological opportunities and constraints in this report is essentially consistent with that undertaken for the Southern Broadacre Planning Study (SBPS, Ref. 10), but there are some minor variations which are apparent when comparing Figures 5.2 and 5.3 of this report. These variations can be attributed to the following factors:

- Recent changes in terminology and presentation of data relating to areas of high ecological value as currently assessed by Research and Planning, ACT Territory and Municipal Services. The present report has generally endeavoured to present this information on a manner compatible with the TAMS data.
- Progress in establishing the boundaries of new nature reserves beyond the notional boundaries indicated in the SBPS ecological report.
- Other planning decisions (e.g. Block 17, Section 102, Symonston) which have implications for how associated land is used or conserved.
- Additional ecological information (e.g. Action Plan No. 28, recent GED surveys) that has been compiled since the SBPS was undertaken.
- Minor boundary variations in areas where boundaries are ill-defined and notional.
To assist in reconciling the advice provided in the present study with that in the SBPS ecological assessment, a comparison of the respective areas and wildlife connectivity routes is presented in Table 5.1. The areas are numbered for reference in Figure 5.4.

It should be appreciated that while the findings of the SBPS ecological assessment were generally strongly reflected in the land use planning recommendations for that study, there were a few areas where the land use recommendations reflected a compromise between ecological and other planning objectives.

The main areas where there are apparent differences between the SBPS land use proposals and the SBPS ecological assessment, or where the SBPS ecological assessment or land use proposals warrant fresh consideration in the light of recent developments or information are as follows (see Figure 5.4 for locations):

**Areas 3, 7 and 8.** These are woodland areas east of Mugga Lane which are located outside committed nature reserves. The ecological values of these areas were documented in the SBPS report (Ref. 10) but they were assessed in the recommendations only in terms of habitat corridors and not specifically as complementary woodland habitat. The concept of core and complementary conservation sites, which was adopted in the native grasslands Action Plan No. 28 (Ref. 6), had not been applied in the earlier woodlands Action Plan No. 27 (Ref. 7). The fact that this concept has been evolving in recent years and has been applied in the EBPS is the main reason underlying perceived differences between the EBPS and the SBPS.

**Area 4. Callum Brae grassland (north).** The SBPS ecological assessment proposed that this area be conserved as grassland habitat within sympathetic land use, and the SBPS land use proposals classified most of this area as ‘Institutional/Nature Reserve’. Since then, just under 20 percent of the area (17/102 Symonston) has been excised under the land swap arrangement for the Narrabundah Long Stay Caravan Park. This action effectively increases the importance of the remainder of the area for nature conservation, based on its previously assessed value as GED habitat. Monitoring for GED within and outside the land swap area during early 2008, however, found no GED, possibly indicating a population decline due to drought conditions in recent years. The habitat remains suitable for the species and there is the possibility of it repopulating the area from the nature reserve further south where it is still present.

In Action Plan No. 28 (Ref. 6), Area 4 (including the land swap site) was assessed as a core grassland conservation site, as was Area 5, which has not been identified as GED habitat, but provides a habitat link between Area 4 and the Callum Brae Nature Reserve (south) in Area 6. The status of Area 4 as a core conservation site was confirmed in March 2008 mapping by Research and Planning, ACT Parks, Conservation and Lands, but Area 5 was assessed as complementary. These classifications have been adopted in the present study. In the case of Area 4, the status of core conservation site is consistent with the SBPS assessment of conserving habitat within sympathetic land use, on the assumption that it would be
managed for multiple use rather than as a nature reserve. Further assessment of this area would be required in the future.

A small additional part of Area 4 and a large proportion of Area 5 were identified in the SBPS land use proposals as an arterial road corridor or institutional use. This is in potential conflict with conservation criteria, although the majority of Area 4 and a viable corridor in Area 5 could still be retained. Further assessment of this issue would need to be addressed at a detailed level.

**Area 9. Amtech site.** The SBPS ecological assessment proposed that this area be conserved as grassland habitat within sympathetic land use, but the area was not included in the SBPS land use proposals. As discussed in Section 5.5, the apparent loss of the GED from this site may be considered to diminish its ecological value, although it still retains other native grassland habitat values, consistent with classifying it as a complementary conservation site. Subject to further detailed assessment, the previous assessment of ‘conserve habitat within sympathetic land use’ is still appropriate.

**Area 10. Cookanalla.** The SBPS ecological assessment proposed that this area be conserved as grassland habitat within sympathetic land use, which is consistent with its current assessment as a complementary conservation site. The previous ecological assessment, however, was not well reflected in the SBPS land use proposals, which designated most of the area as ‘urban capable subject to criteria’ with the remainder as ‘urban capable’. While the former classification offered some possibility of retaining ecological values, the land was isolated from other conservation areas by ‘urban capable’ land (within current Area 11).

There is no more recent information relating to Area 10 (or Area 11) that would justify changing the previous ecological assessment of these areas. Any conflict between development and conservation objectives would need to be addressed at a more detailed level. Subject to such further assessment, the previous assessment of ‘conserve habitat within sympathetic land use’ is still appropriate.

Other differences between the EBPS and SBPS ecological assessments relate essentially to how notional ecological boundaries have been drawn in the respective studies. These differences are not significant and further refinement of such boundaries is needed in any case in translating the ecological assessment into specific planning boundaries. This should be addressed through the interpretation of dynamic ecological processes rather than rigid mapped boundaries, and should involve further specialist ecological advice at the detailed planning stage.

In summary, where there are apparent differences between the EBPS and the SBPS in this report, these differences relate to the SBPS land use proposals rather than the ecological assessment. This illustrates the need for compromise in some situations between ecological objectives and other planning objectives. In such situations, the ecological assessment remains valid, but there is a need for more detailed investigation as a basis for further planning. Based on the SBPS land use proposals, this applies particularly to Areas 4, 5, 9, 10 and 11.
While the terminology of core and complementary conservation sites has been developed since the SBPS was undertaken, the assessment in that study of some areas as ‘conserve habitat within sympathetic land use’ can still be consistent with the classification of complementary conservation sites and possibly core conservation sites which are managed for multiple use. Further detailed ecological assessment during the precinct and concept planning stages to confirm or update the ecological values within such sites and in relation to adjoining areas will be important in influencing future land use and development decisions.

5.9 Conclusions

The ecological constraints identified for the study area are summarised in Figure 5.2 according to the hierarchy described in Chapter 4. The boundaries in Figure 5.2 have been generalised to some extent, and may be subject to refinement in the course of more detailed planning. A large proportion of the land which is subject to ecological constraints is used for Defence purposes or for Canberra International Airport.

The main ecological constraints within the study area can be summarised as follows:

- Development within some large parts of the study area is potentially constrained by the presence of the endangered ecological community, natural temperate grassland.

- An even larger area is constrained by the presence of habitat for the endangered grassland earless dragon. Much of this habitat is within the natural temperate grassland, but much of it is within native pasture, while some buffers or connecting areas are located in degraded native pasture or exotic pasture.

- Most of the records or likely habitat for other threatened grassland species are within the above natural temperate grassland/GED habitat areas and do not impose significant additional constraints. The main exception to this are the scattered occurrences of button wrinklewort, which appear as localised constraints without having major strategic implications.

- Most of the important woodland areas within and around the study area are within proposed nature reserves or the MTA, but there are some other smaller woodland patches which are important as bird habitat or may be strategically important in the functioning of a bird movement corridor through the study area.

There is an outstanding ecological opportunity within the study area to create a series of viable grassland reserves with a view to ensuring the long term survival in the wild of the grassland earless dragon. The significance of this is emphasised by the strong possibility that, if such action is not taken, the ACT populations of this species could become extinct in the wild in the medium (or possibly even short) term. If these ACT populations are a separate subspecies from those near Cooma (see Section 3.5), this could mean extinction of the entire subspecies.
The first steps in this direction have already been taken through the withdrawal from lease of two areas of rural land in the south of the Jerrabomberra Valley. The current approach to the remainder of this habitat is to seek its sympathetic management through the Memoranda of Understanding with the Commonwealth Government or land management agreements with rural lessees. While this may be adequate in maintaining the status quo, it does not offer the same opportunity to undertake proactive steps, such as habitat manipulation, to counter threats that may be beyond the control of the land manager. As reported in Section 3.4, GED numbers have dropped dramatically in both Majura and Jerrabomberra in recent years, with drought and overgrazing by kangaroos being suggested as possible contributing factors. Management of these threats may not be an easy task but is likely to be facilitated if nature conservation is seen as the primary purpose of the land, rather than being secondary to another, albeit sympathetic, land use.

The ACT Government is limited in what it can achieve in this direction as much of the prime habitat is Commonwealth land, and is in active use for Commonwealth purposes. Resolution of this issue is beyond the scope of the present study. On the other hand, Commonwealth ownership also precludes development of the land for ACT purposes, which at least may maintain the status quo in terms of ecological management.

One point of debate with respect to natural temperate grassland/ GED conservation is how much of the known grassland habitat needs to be conserved to achieve the survival of the species, as well as protecting other grassland values. There is one school of thought that, because such habitat/ community is so scarce, all of it should be protected, irrespective of other considerations. This amounts to single-issue decision-making, which is not consistent with a triple bottom line sustainability approach.

The alternative approach is one of compromise, which is reflected in the rationale underlying the Southern Broadacre Planning Study. In this case, however, the approach involved some uncertainty as to whether the compromise measures could be implemented in a way which would achieve their aims (from both conservation and development perspectives).
6. PLANNING AND DEVELOPMENT ACT REQUIREMENTS

The ACT Planning and Development ACT 2007 (P&D Act), which became effective from 1 April 2008, contains environmental assessment processes which are intended to address objectively all issues falling under the broad scope of the environment, as defined in the Act. These processes provide mechanisms for addressing the potential conflicts between conservation and development objectives which may arise.

Part 5.6 of the P&D Act makes provision for strategic environmental assessments (SEA), an environmental planning tool which has not been widely used in Australia to date, but is attracting increasing recognition nationally and internationally (e.g. Ref. 27). SEA offers the opportunity to address environmental issues from a ‘big picture’ perspective, providing a meaningful context for project-specific assessment.

Examples stated under s.99 of the P&D Act when a SEA may be prepared include a major land use policy initiative or a major plan variation, but these examples do not limit the potential application of SEA. It may be feasible, for example, to apply the SEA approach to the strategic conservation within the ACT of natural temperate grassland and the species (threatened or otherwise) that this community supports. This would be a natural extension of Action Plan No. 28 and subsequent related work, which provides a sound technical information base for such assessment. Such background, supported by a formal process, would provide a strong basis for objectively assessing any development proposals that may impact on that community or its species.

Chapter 8 of the P&D Act provides for the preparation of environmental impact statements (EIS) for certain types of development proposals, as specified in Schedule 4. The criteria for requiring an EIS under Part 4.3 of Schedule 4 include adverse impacts on threatened species or communities or the clearing of more than 0.5 ha of native vegetation. These criteria are likely to trigger an EIS for any proposal that is likely to have a significant effect on any of the ecological values discussed in this report. The optimum assessment of such effects is likely to be facilitated within the context of an appropriate SEA.
7. **EPBC ACT IMPLICATIONS**

Because of the large number of threatened species and ecological communities within the study area, development in much of the area is likely to justify referral under the *EPBC Act*. In particular, any development with potential to impact on the GED is likely to experience intense scrutiny. This in turn could result in costs and delays for developers.

This situation is most likely to arise in relation to projects in Level 3 areas in the hierarchy identified in Chapter 4. The Commonwealth Department of the Environment, Water, Heritage and the Arts (DEWHA) is likely to raise justifiable concerns about the incremental impacts on small areas of GED habitat and associated land. These concerns can most effectively be addressed by developing a comprehensive strategic conservation plan for the GED in the ACT, which is given status through the SEA provisions of the *P&D Act* (see Chapter 6). Such a plan should preferably take account also of adjoining areas of New South Wales, should build on the existing Action Plan, and should have endorsement under the *EPBC Act*. It would enable the issue to be addressed in its full context with a high degree of confidence about future commitments and who would be responsible for implementing them. It would avoid a plethora of limited and somewhat meaningless management plans which are aimed more at satisfying government processes than achieving the best environmental outcome. Importantly, from a development viewpoint, it could offer a higher level of certainty to prospective developers than is possible under the current *EPBC Act* procedures.

The *EPBC Act*, as it has generally operated to date, has not been set up to address ‘big picture’ issues, but is focused on individual projects. Amendments to the Act made in 2006 include provision of incentives for developments to be considered earlier in the planning process and in the context of regional plans and strategic assessments (Ref. 23). It is understood, however, that the practical implementation of such amendments is still at an early stage. When the Commonwealth and ACT approaches to SEA are adequately developed, it would be desirable for these to be addressed through an extension to the bilateral Commonwealth-ACT agreement under the *EPBC Act* that is currently being negotiated.

If the EBPS results in a plan identifying proposed development areas and conservation areas within the study area, this could provide the basis for using the *EPBC Act* as recently amended, to address holistically the conservation of the endangered species it is intended to protect, as well as providing a valuable context beyond those in the Action Plans for conservation issues in the Majura and Jerrabomberra Valleys. Such action is seen as a follow-up to the current study, rather than a part of it. Until the ecological issues in the study area are addressed at this level, with involvement of the ACT, Commonwealth and desirably New South Wales Governments, any plans emerging from the EBPS face the risk of being riddled with uncertainty.
REFERENCES AND INFORMATION SOURCES


15. Murray Evans, Research and Planning, pers. comm.


18. Jenny Bounds, Canberra Ornithologists Group, pers. comm.


Figure S.1 Summary of ecological constraints
Figure 3.2  Grassland earless dragon habitat
Adapted from Figure 6.1 of Action Plan No. 27 and information compiled for Southern Broadscale Planning Study ecological assessment.

Figure 4.1 Wildlife movement corridors
<table>
<thead>
<tr>
<th>Area no./ description</th>
<th>EBPS</th>
<th>SBPS</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. ‘Mugga Mugga’</td>
<td>Complementary conservation site.</td>
<td>Not specifically identified as a constraint, but acknowledged as a Special Purpose Reserve for Education.</td>
<td>While not shown as a constraint on the SBPS map of recommended conservation options, it was assumed that the existing education/conservation use would be maintained.</td>
</tr>
<tr>
<td>3. Woodland within quarry lease</td>
<td>Complementary conservation site.</td>
<td>Not identified as a constraint.</td>
<td>SBPS did not specifically identify areas of woodland value as complementary habitat outside proposed nature reserves.</td>
</tr>
<tr>
<td>4. Callum Brae grassland (north)</td>
<td>Core conservation site.</td>
<td>Conserve habitat within sympathetic land use.</td>
<td>Because 17/102 Symonston has been excised from this area, it is considered appropriate to conserve the rest of this area as core habitat, particularly for the grassland earless dragon.</td>
</tr>
<tr>
<td>5. Habitat (connectivity) corridor between Callum Brae grassland areas</td>
<td>Complementary conservation site.</td>
<td>Connectivity route/habitat corridor.</td>
<td>Essentially consistent. Complementary status is a means of maintaining a connectivity route.</td>
</tr>
<tr>
<td>7. Woodland in leases fronting Mugga Lane</td>
<td>Complementary conservation site.</td>
<td>Habitat corridor link.</td>
<td>Essentially consistent (as for Area 5).</td>
</tr>
<tr>
<td>8. Woodland in leases at south end of ridge</td>
<td>Complementary conservation site.</td>
<td>Not identified as a constraint.</td>
<td>As for Area 3.</td>
</tr>
<tr>
<td>11. Habitat (connectivity) corridor between Cookanalla and Bonshaw</td>
<td>Local wildlife connectivity route.</td>
<td>Habitat link.</td>
<td>Consistent</td>
</tr>
<tr>
<td>12. Bonshaw Hill</td>
<td>Core conservation site – potential nature reserve.</td>
<td>Proposed nature reserve.</td>
<td>Consistent. As it is Commonwealth land, declaration as a nature reserve is beyond the control of the ACT Government.</td>
</tr>
<tr>
<td>14. Wetland area west of Harman</td>
<td>Core conservation site – potential nature reserve.</td>
<td>Potential nature reserve subject to grassland rehabilitation.</td>
<td>Consistent subject to minor boundary variations.</td>
</tr>
<tr>
<td>17. Grassland adjoining Woods Lane – habitat connection to NSW</td>
<td>Complementary conservation site, local wildlife connectivity route.</td>
<td>Potential nature reserve subject to rehabilitation, habitat corridor.</td>
<td>Broadly consistent. SBPS indicates potential for limited development, however.</td>
</tr>
<tr>
<td>19. Grassland corridor between Mike’s Hill and Callum Brae South nature reserves (Prison site)</td>
<td>Local wildlife connectivity route.</td>
<td>Habitat corridor between conservation areas.</td>
<td>Consistent.</td>
</tr>
</tbody>
</table>
Figure 5.1 Study area sections
Figure 5.2 Ecological constraints
Figure 5.3 Southern Broadacre Planning Study - recommended conservation options
Figure 5.4 Numbered areas for comparison between EBPS and SBPS

See Figure 5.2 for legend relating to ecological constraints.