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Expert Report

COURT DETAILS

Court	Land and Environment Court of NSW
Division	Class 1
Registry	Land and Environment Court Sydney
Case number	2017/00234018

TITLE OF PROCEEDINGS

First Applicant	Timpag Investments Pty Limited ACN 142295912
First Respondent	LIVERPOOL CITY COUNCIL ABN 84181182471

FILING DETAILS

Filed for	LIVERPOOL CITY COUNCIL, Respondent 1
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ATTACHMENT DETAILS

In accordance with Part 3 of the UCPR, this coversheet confirms that both the Lodge Document, along with any other documents listed below, were filed by the Court.

Expert Report (T James expert report.pdf)

[attach.]

TIMPAG INVESTMENTS PTY LTD V LIVERPOOL CITY COUNCIL – Land and Environment Court Proceedings No. 00234018 of 2017 – 36 Lyn Parade, Prestons

Statement of Evidence of Teresa James

9 January 2018

1. INTRODUCTION

This statement of evidence has been prepared as part of the Land and Environment Court proceedings 00234018 of 2017. A development application to remove all vegetation from the subject site at 36 Lyn parade, Prestons was refused by Liverpool City Council (LCC) in June 2017. The vegetation comprises an endangered ecological community and vulnerable species protected as an offset for previous development of a larger site in 1999.

The subject site is 1.06 ha in size and located at 36 Lyn parade, Prestons (Lot 10 DP 1003837) in south-west Sydney. It is bounded by warehouses and has frontage to Lyn Parade, within the Prestons industrial estate. It is located within the IN3 Heavy Industry Zone pursuant to the provisions of the Liverpool Local Environmental Plan (LLEP) 2008. The high conservation value of bushland generally within the Prestons local area has long been acknowledged (NPWS 1997) with the communities subsequently listed as endangered under the Threatened Species Act 1995 (TSC Act) and Environment Biodiversity Conservation Act (EPBC Act). Industrial and residential development has resulted in ongoing clearing of this bushland. Within the vicinity of the subject site several patches of bushland remain mostly associated with Maxwell's Creek and the National Broadcasting Station site but there are no formal conservation reserves.

I am a botanist/ecologist working as a consultant specialising in flora survey, conservation assessment and environmental education within NSW. I have worked in the field of botany and ecology for 40 years including 19 years for the NSW Government at the Royal Botanic Gardens, Sydney (RBG) and secondment to the NSW National Parks & Wildlife Service (NPWS) as principal author of the Western Sydney Urban Bushland Biodiversity Survey. I assisted Liverpool City Council with DA assessments between 2000 and 2008. I have extensive knowledge of the vegetation of the greater Sydney region, including threatened communities and species. My *curriculum vitae* is included in Annexure 2.

This Statement has been prepared in accordance with the following documents:

- Land and Environment Court Practice Note Class 1 appeals;
- Division 2 of Pt31 of the *Uniform Civil Procedures Rules 2005;* and
- the Expert Witness Code of Conduct provided in Schedule 7 of the *Uniform Civil Procedures Rules 2005*.

My evidence is based on relevant reports, a site inspection and personal knowledge/expertise of the communities, species and geographical areas relevant to this matter. Key documents relied upon are listed below with full references provided in Annexure 1**.**

- Statement of Facts and Contentions (LEC Proceedings No. 00234018 of 2017)
- Cumberland Ecology (Sept 2016) Species Impact Statement for Timpag Investments Pty Ltd
- Humphries, Robert, Eco Logical Australia (Dec 2017) Expert Statement – Response to Facts and Contentions - Timpag Investments Pty Ltd v Liverpool City Council, Land & Environment Court Case 2017/00234018

- Thomas, D. for Lesryk Environmental Consultants (Aug 1998) Species Impact Statement for *Acacia pubescens* and *Meridolum corneovirens* at proposed industrial development site, 42A Jedda Road, Prestons
- Thomas, D. (undated) Draft Management Plan for Lot 10, 42A Jedda Road, Prestons
- Office of Environment & Heritage (27/2/2017) Comments on SIS for 36 Lyn Parade Prestons, letter to Mr Ivan Kokotovic Liverpool City Council
- Liverpool Local Environment Plan 2008 and Development Control Plan 2008

2. BACKGROUND

2.1 History

The subject site (Lot 10 DP 1003837) was created through industrial subdivision of a 4.4 ha site (Lot 1 DP 626996) at 42A Jedda Road, Prestons in 1999. The original site of 4.4 ha contained 2 ha of an endangered ecological community and populations of two threatened species, Downy Wattle *Acacia pubescens*, and the Cumberland Land Snail *Meridolum corneovirens*. This vegetation had been illegally cleared two years earlier in 1997, however, good regeneration was occurring in 1999 at the time of the development application (Thomas 1998).

As part of the development consent for the subdivision there was a requirement to protect and manage 50% of the native vegetation within a Conservation Area on Lot 10 DP 1003837 (LCC 1999) as an offset to vegetation clearing over the remainder of the site. The site was burdened accordingly and subject to a conservation management plan through a Section 88B planning instrument under the Conveyancing Act 1919. The clear intention of the s88B was to permanently retain and manage bushland in accordance with a plan of management (PoM) with future clearing and development of the site prohibited. Although all records of the Plan of Management (PoM) for the conservation area held by Liverpool City Council are reportedly destroyed by fire, a draft plan is held by the Office of Environment & Heritage (OEH) (Annexure 5). The aim of the plan is to permanently retain the conservation and aesthetic values, with weed control and monitoring to continue indefinitely. The conditions of consent (LCC 1999) indicate that the proponent was responsible for preparation and implementation of a Plan of Management in Lot 10. The conditions also state that the proponent was to provide resources for at least three years (based on a recommendation from Mr R. Humphries then Manager of the Sydney Zone Threatened Species Unit [NPWS May 1999] and now the ecologist acting for the Applicant in this case) although responsibility for the conservation area and ongoing implementation of the plan would remain with the landowner.

In 2015 Timpag Investments Pty Ltd commissioned Cumberland Ecology to undertake a Species Impact Statement to support a new development application (DA-1250/2016) to remove all vegetation from 36 Lyn parade, Prestons (Lot 10 DP 1003837). The supporting documents also refer to proposed construction of a warehouse building but no details are provided. The DA was determined as a *Species Impact Development* requiring public exhibition and concurrence from OEH.

The development application was refused by LCC on 19 June 2017 due to insufficient information provided to demonstrate that the proposal will not have an adverse significant impact on an endangered ecological community and vulnerable species listed in the Threatened Species Conservation Act 1993 (TSC Act), and impacts on land identified as Environmentally Significant Land under the LLEP 2008.

2.2 Endangered communities

The Prestons local area contains a range of vegetation communities associated with Wianamatta Shale, smaller patches of older Tertiary alluvium (deposited by ancient watercourses) and more recent alluvium. Transitions can be observed across these geologies with increasing distance from creek-lines, and often forming mosaic communities in flatter areas with intermittent flooding. All these communities are now listed as endangered under environmental legislation.

Native vegetation at the subject site is presently dominated by Broad-leaved Ironbark *Eucalyptus fibrosa* and the Paperbark *Melaleuca decora* as a dominant smaller tree. These species are consistent with both Cooks River Castlereagh Ironbark Forest (CRCIF) and Shale Gravel Transition Forest (SGTF). CRCIF is a "Castlereagh Woodland" community found on localised patches of thicker deposits of older alluvium including ironstone gravels. SGTF is a transitional community occurring in zones where the Castlereagh Woodlands and Cumberland Plain Woodland (on the more extensive Wianamatta shale) intergrade. SGTF typically has less ironstone gravel influence in the soil, is less shrubby and contains more shale-loving species typical of Cumberland Plain Woodland.

Due to the history of clearing and fire at the site, lack of documentation prior to 1999 and clearing of surrounding vegetation, it is unclear which community (if any) is dominant. Based on available information it is most likely that the vegetation is intermediate (see 4.1 of this statement). Structural differences between the two communities has been obscured by the disturbance regime with faster growing and readily seeding species such as *Melaleuca nodosa* (more typical of CRCIF) favoured.

It is noted that the SIS for the original DA (Thomas 1998) and PoM for the conservation area identifies the vegetation as Shale Gravel Transition Forest (see Appendix 1 of Annexure 5). The Liverpool City Council Biodiversity Management Plan (2012) identifies vegetation at the site as Broad-leaved Ironbark – Grey Box – Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain which is equivalent to Shale Gravel Transition Forest (SGTF).

SGTF is listed as an endangered ecological community in NSW and is listed together with Cumberland Plain Woodland as a *critically endangered* EEC at the national level. CRCIF is listed as an endangered ecological community at state and national levels. All vegetation at the subject site will be cleared in the proposal. A referral to the Department of Environment and Energy (Australian Government) is required for both the EEC and *Acacia pubescens*. A referral had not been submitted by 3 February, 2017 (letter from the Australian Government to Liverpool City Council).

2.3 Threatened species

Two threatened species have been recorded from the subject site, Downy Wattle *Acacia pubescens* and the Cumberland Plain Land Snail *Meridolum corneovirens*. The woody twining shrub Native Pear *Marsdenia viridiflora* subsp. *viridiflora* was recorded from the larger site in 1999 and was to be propagated and re-established within the conservation area. Native Pear is now listed as an endangered population in the Liverpool LGA.

Acacia pubescens Downy Wattle

A significant population of *Acacia pubescens* occurs within the Prestons local area with the highest density found on the subject site (Figure 4.3 of SIS 2016). Prior to subdivision of the larger lot in 1999, a total of 225 plants were recorded across the site. Development consent required 50% of the lot to be retained as a conservation area containing approximately 80 plants. Survey for the SIS undertaken for the latest DA recorded 84 plants from the subject site and more recent survey

undertaken by Eco Logical (Humphries 2017) increased the number of plants to 171, all of which will be cleared in the proposal.

*Due to the clonal nature of *Acacia pubescens* stems do not equate to genetic individuals and accordingly actual population size will be less, increasing the impact of any further losses. In this report numbers cited refer to stems and not genetic individuals.

Meridolum corneovirens Cumberland Plain Land Snail
Ten individuals of the Cumberland Plain Land Snail (CPLS) were recorded in 1998 (Thomas 1998) within the area subsequently retained (i.e. the subject site). A further 10 individuals were recorded from adjoining sites. The recent SIS (Cumberland Ecology 2016) accompanying the current DA failed to locate any snails and dismissed any potential for occurring at the site. The survey and assessment undertaken is inadequate, the SIS fails to refer to the earlier records, target surveys in previous known locations or under suitable weather conditions. Survey was undertaken for just 2-man hours in February and March with hot, dry temperatures of 32.7^{o}C and 40°C (Table 4.2 of SIS). The CPLS can burrow down several centimetres into the soils to avoid hot, dry conditions (Cumberland Plain Land Snail profile). It is also noted that survey was undertaken at the base of specific trees, yet the snails were found previously, as is also typical for the species, below ground debris and urban litter more generally. The CPLS is listed as endangered in NSW.

Marsdenia viridiflora subsp. *viridiflora* Native Pear
Native Pear, a woody twining shrub, was recorded in the original SIS (Thomas 1998) at the corner of Jedda Road and Lyn Parade. At the time it was identified as *regionally significant* and provisions made to re-establish the taxon within the conservation zone through propagation and transplantation. Native Pear is now recognised as an *endangered population* in parts of western Sydney including the Liverpool LGA. The recent SIS (Cumberland Ecology 2016) does not refer to the previous record and dismisses any potential for occurring at the site in table 3.1. stating that “no suitable habitat is present within the study area”.

3. CONTENTIONS

Contention 1 - Impacts to endangered ecological communities and vulnerable threatened species

Insufficient information has been submitted to demonstrate that the proposal will not have an adverse significant impact on the *Cooks River/Castlereagh Ironbark Forest EEC and Downy Wattle Acacia pubescens (vulnerable) listed at both state (TSC Act) and national levels (EPBC Act).*

3.1 Impacts

The Species Impact Statement SIS (Cumberland Ecology 2016) and Statement of Environmental Effects SEE (Michael Brown Planning Strategies 2016) both identify loss of all vegetation at the site:

- Removal of all (0.90 ha) the EEC (Shale Gravel Transition Forest SGTF/Cooks River-Castlereagh Ironbark Forest CRCIF); and
- Removal of all (c. 171 stems) Downy Wattle *Acacia pubescens* and associated habitat (0.9 ha).

Cumulative impacts from the original development and the current proposal will result in the loss of 2 ha of the EEC and >300 stems of *Acacia pubescens*.

The loss of all vegetation is clearly a significant impact (100%) on both the endangered ecological community and *Acacia pubescens* at the subject site and the original development site (Lot 1 DP 626996). It will also be a significant impact on the Cumberland Plain Land Snail if still present and potentially *Marsdenia viridiflora* subsp. *viridiflora* if re-establishment was successful.

Shale Gravel Transition Forest (SGTF)/Cooks River-Castlereagh Ironbark Forest (CRCIF) EEC

The test of significance (7-part test) requires assessment of impacts on a *local occurrence* of the EEC. Some connectivity is likely between similar vegetation at the subject site and on the opposite side of Lyn Parade and consequently indirect impacts may be expected to occur beyond the site. The local occurrence is extended from the subject site, therefore, to include the eastern section of the remnant to the west of Lyn Parade comprising a total area of approx. 1.4 ha (see figure 1, Annexure 4). With increasing distance and change in vegetation type the likelihood of effective connectivity is reduced. Impacts of the proposal on this local occurrence will be approximately 65%.

The SIS fails to identify a *local occurrence* in the 7-part test with assessment undertaken based erroneously on an exaggerated study area of approx. 40 ha (see figure 2.1 of Cumberland Ecology 2016) and the locality (5 km radius of the site). At these scales the SIS calculates that the level of impact will be only 5% (6.3.2 of SIS) and concludes that this is insignificant. This broader scale approach is contrary to the intention of the *Threatened Species Conservation Amendment Act 2002* to focus assessment of impacts at a more local level. Furthermore, bushland within the study area and locality includes a range of ecological communities, the identification of which is not shown to have been verified in the field or critically examined and cannot be assumed to be comparable with that at the subject site. The level of impact on the EEC has been significantly underestimated (see Section 4.3 of this report).

Downy Wattle *Acacia pubescens*

Similarly, the test of significance requires assessment of impacts on a *local population* of *Acacia pubescens.* The only plants of *A. pubescens* within the SIS study that could reasonably be expected to be cross-pollinating with those at the subject site are those in the remnant directly west of Lyn Parade and potentially along Maxwell's Creek (see figure 2 of Annexure 4). The SIS appears to include all plants within the study area as the local population although this is not specifically stated. Nevertheless, even based on the larger local population, the SIS concludes that there will be a *moderately significant impact* on the species (Chapter 10).

Assessment of *cumulative impacts* of the earlier subdivision and the current proposal are also relevant and not addressed in the SIS. Over 300 stems of *Acacia pubescens* will be lost in total.

Cumberland Plain Land Snail *Meridolum corneovirens* and Native Pear *Marsdenia viridiflora* subsp. *viridiflora*

Insufficient information has been provided to demonstrate that there will not be a significant impact on the Cumberland Plain Land Snail (CPLS) or an endangered population of *Marsdenia viridiflora* subsp. *viridiflora.* The CPLS was recorded previously from the subject site Thomas (1998) and adjoining lands with about 50% of the local occurrence at the site. The SIS fails to consider these records and survey was inadequate and poorly timed. In the absence of adequate survey, it should be assumed that the snail is still present at the site. The conservation plan prepared for the subject site in 1999 required re-establishment of the Native Pear but again the SIS makes no reference to the species, the conservation plan or results of the translocation.

3.2 Compensation for impacts

The SIS proposes to compensate for removal of the EEC and *Acacia pubescens* by purchase of biobanking credits as an offset. The use of offsetting to compensate biodiversity impacts has increased in recent years but primarily associated with major state significant projects. OEH have developed a set of offsetting principles to provide a useful framework when considering impacts and the appropriate offset requirements (see Annexure 3). The SIS was required to consider these principles as part of the Director General's requirements (7.1.1) but no relevant discussion was provided. The principles of most relevance in this case are:

3 Offsets must never reward ongoing poor performance – offset schemes should not encourage landholders to deliberately degrade or mismanage offset areas to increase the value from the offset;

5 Offsets must be underpinned by sound ecological principles;

6 Offsets should aim to result in net improvement in biodiversity over time;

9 Offsets must be quantifiable – the impacts and benefits must be reliably estimated;

10 Offsets must be targeted on basis of like-for-like or better conservation outcomes;

11 Offsets must be located appropriately;

12 Offsets must be supplementary – they must be beyond existing requirements and not already funded under another scheme.

A biobanking assessment was undertaken to determine the level of offsetting required (i.e. number of credits to purchase). Offsetting of impacts at the subject site, however, is inappropriate when considered in relation to the OEH principles and in particular due to the following:

- The high conservation significance of both SGTF & CRCIF (endangered) and the local population of *Acacia pubescens* (see Section 4.2 of this statement). Away from the edges and a central zone of disturbance created by past clearing the condition of vegetation is moderate to good. There is functional connectivity with similar vegetation on the other side of Lyn Parade and the EEC remains viable. *Acacia pubescens* at the subject site is one of only three significant populations in the locality, none of which are known to be managed for conservation purposes (OEH Feb 2017). Actual population size within the subject site and study area in respect of genetic individuals will be lower than the numbers provided in the various reports. Lower levels of genetic diversity within the species increases the importance of protection across its known range and particularly of denser populations. As discussed by OEH (Feb 2017) over 50% of populations identified in the *Acacia pubescens* Recovery Plan had less than 20 stems and only 9% occupied greater than 1 ha of habitat. This is unlikely to have changed significantly.

- Identification as Environmentally Significant Land (LLEP 2012) and Regional Core in the Liverpool Biodiversity Management Plan (2012). See Contention 2.

- The current s 88B planning protection over native vegetation at the subject site that prohibits clearing with the purpose of permanently protecting threatened flora and fauna. Vegetation on the subject site is already an offset for the original development. Principle 12 of the offsetting principles states that offsets must be supplementary and be beyond existing requirements.

- Vegetation at the site also provides known habitat for the endangered Cumberland Plain Land Snail and potentially *Marsdenia viridiflora* subsp. *viridiflora*. No adequate impact assessment has been undertaken for these entities.

The Biobanking Credit report indicates that both the EEC and *Acacia pubescens* assessments generate a red flag. Section 9 of the BioBanking Assessment Methodology (OEH 2014) requires that impacts on red flag areas are to be avoided and that development is required to improve or maintain biodiversity values. Where there will be an adverse impact on red flag areas it must be shown that they are a) in low condition or unviable and b) have minimal contribution to regional biodiversity values. The SIS does not provide sufficient information to support either. To the contrary, native vegetation at the subject site contributes significantly to local and regional biodiversity in respect of both the EEC and *Acacia pubescens* (see Section 4.2).

Mr Humphries (2017) suggests that long-term viability of the EEC and *Acacia pubescens* habitat is low due to the surrounding urban landscape, and that this is sufficient reason to clear and offset the impacts. The protection of threatened ecological communities and species within the urban landscape is fundamental to biodiversity conservation in the Sydney region. A comprehensive, adequate, representative and viable conservation system cannot be achieved without conservation on private lands in both urban and rural landscapes. The new Biodiversity Conservation Act (2016) particularly emphasises the important of private lands conservation.

Both SGTF and CRCIF are typically resilient communities occurring on quite infertile soils and connectivity across Lyn Parade is sufficient to prevent genetic isolation. Long-term management is required but an assumption that this cannot occur and that the site should therefore be cleared is inappropriate. All EEC's and bushland within Sydney urban areas are disturbed, their protection and recovery depend on realising opportunities for retention and management on both private and public lands.

The SIS does not demonstrate that impacts on the EEC, *Acacia pubescens, Meridolum corneovirens and Marsdenia viridiflora* should or can practically be offset by purchasing biodiversity credits. At the time of preparation of the SIS no suitable credits were available at least for CRCIF and *Acacia pubescens*. Some potential credits have been identified for CRCIF and *Acacia pubescens* by Mr Humphries (2017) but these remain opportunistic and have not been assessed in relation to the OEH principles of offsetting or provide offsets for other threatened entities known from the site

The significance of the vegetation, both as a restricted EEC close to its southern limit, as part of a larger patch of bushland of >10 ha and in providing habitat for a large and healthy population of *Acacia pubescens*, has been undervalued. The geographical location of the site is a key factor and cannot be simply compensated through offsetting.

3.3 Other inadequacies of the SIS

I concur with comments provided by OEH (Feb 2017) that the SIS (Cumberland Ecology 2016) is generally inadequate and does not meet the required standards or guidelines. Inadequacies include:

- No reference to or consideration of previous reports relevant to the site e.g. SIS for original subdivision, PoM for the Conservation Area.
- Inadequate mapping of the subject site at an appropriate scale to clearly identify locations of threatened species, survey quadrats/transects, and regional vegetation mapping.

- No reference to known records of the Cumberland Plain Land Snail at the subject site or to the potential for *Marsdenia viridiflora* subsp. *viridiflora* being present following re-establishment (as part of Plan of Management)
- Inadequate flora and fauna survey.
    - Surveys were focused across the larger study area at the detriment of the subject site. There appears to have been no general flora survey at the subject site and no details of time & location of threatened species searches. The number of native species recorded is significantly less than previous listing for the Conservation Area PoM, it is unlikely that these have all become extinct at the site.
    - Flora survey was limited to the hottest time of the year (Jan-early March). Targeted search for the Cumberland Plain Land Snail was undertaken in hot, dry conditions when any snails present are likely to have been below the soil surface or well hidden under woody debris and urban litter, not only at the base of trees.
- Inadequate presentation of survey data and results. No quadrat data is provided other than species present in the general species list. No details of the biobanking assessment are provided.
- No evaluation of community floristics or previous vegetation mapping of the site to inform identification of the ecological community present at the subject site or within the study area.
- Overestimation of potential habitat for *Acacia pubescens* within the locality. The SIS identifies 1342 ha of potential habitat but OEH analysis found only 438 ha. The SIS also overestimates the number of records for the species within the study area (OEH Feb 17).
- Incorrect information relating to the number of populations of *Acacia pubescens* within the region and the level of protection within conservation reserves.
- Inadequate assessment of impacts including 7-part tests (see Section 4.3).
- No assessment of impacts on the Cumberland Plain Land Snail or *Marsdenia viridiflora* subsp. *viridiflora*.

Insufficient information has been provided to demonstrate that there will not be a significant impact on the EEC (SGTF/CRCIF), *Acacia pubescens*, *Meridolum corneovirens* or *Marsdenia viridiflora* subsp. *viridiflora*.

4. SUPPORTING INFORMATION

4.1 Identification of EEC

The identity of the EEC is not clear cut as discussed in section 2.2 of this report. The SIS assumes the vegetation is Cooks River Castlereagh Ironbark Forest (CRCIF) without floristic analysis or reference to previous studies. Based on local vegetation patterns, soil characteristics, analysis of plant species present, reference to characteristic species of the relevant final determinations and personal knowledge, it is most likely that the vegetation is intermediate between CRCIF and Shale Gravel Transition Forest (SGTF).

<u>Local vegetation patterns</u>

The study area contains a range of vegetation communities associated with different geologies including Wianamatta shale, Tertiary alluvium (deposited by ancient watercourses) and more recent Quaternary alluvium. Transitions can be observed across these geologies with increasing distance from Maxwell Creek and mosaic communities often occur where flooding and/or patches of ironstone gravels are variable across the landscape. The influence of alluvial soils decreases away

from the creek until more fertile clay soils of the Wianamatta shales dominate. The location of the subject site is approx. 400 m from Maxwell Creek and consistent with a transition zone between the older alluvium and shale.

Floristics

Based on the total list of native species for the site (Thomas undated, Cumberland Ecology 2016) 65% of the characteristic species for SGTF as listed in the final determination are recorded compared with 47% of the characteristic species for CRCIF as listed in the final determination. Characteristic species of both communities are well represented at the site. Structural differences between the two communities have been obscured by a disturbance regime of clearing and fire.

Irrespective of the relative dominance of CRCIF or SGTF at the site, both are endangered ecological communities with the only difference at the national level where SGTF is considered critically endangered together with Cumberland Plain Woodland and requires referral under the EPBC Act.

4.2 Conservation significance

Shale Gravel Transition Forest /Cooks River-Castlereagh Ironbark Forest

The condition of vegetation at the subject site is assessed in the SIS as degraded and isolated (8.1.2). Humphries (2017) supports this view. I disagree with these opinions based on the current condition of the site and following facts:

- Vegetation structure is intact with tree, shrub & ground layers well represented. Due to a history of clearing and fire (at least since 1998) the trees have persisted as relatively young regrowth. With time and less disturbance, a more mature structure could be attained. It is inappropriate for seral stages of vegetation to be assessed as degraded when compositional, structural and functional importance can be demonstrated (Doherty 1998). Resilience and regeneration potential of the vegetation is good.

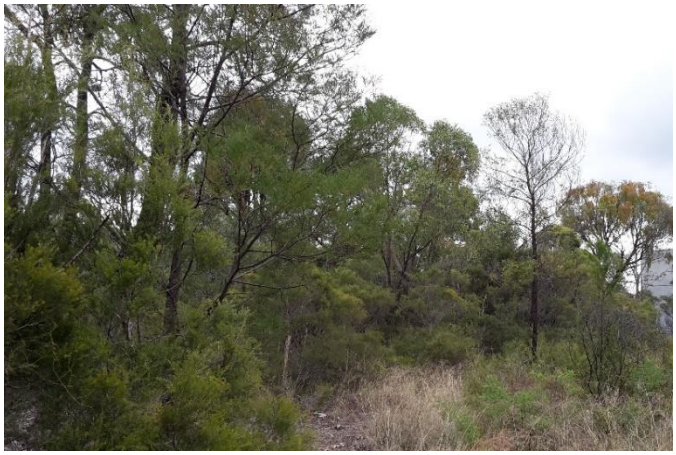

Photo 1 – Moderate to good condition vegetation at subject site

- Based on data from two 20 m x 20 m quadrats (Q1 and Q2) collected for the SIS (Cumberland Ecology 2016) species richness is moderate with 31 & 26 native species recorded in quadrats 1 and 2 respectively. A total of around 40 native species were recorded from the quadrats. No general species list for the subject site was compiled for the SIS. Good condition examples of SGTF and CRCIF may typically have between 35 and 45 species within this size quadrat. Due to the high level of cover/abundance of African Lovegrass in these quadrats it is likely the quadrats

were located in more disturbed parts of the site; mapping does not clearly show the location of the quadrats. It is understood that there was some scalping of soil when vegetation was illegally cleared back in 1997 (Thomas undated) which may have resulted in loss of some of the soil seed bank and rootstock. A more general species list compiled for the Conservation Area Plan of Management recorded 87 native species (See Annexure 5). It is likely that actual species richness is closer to that recorded on the Plan of Management. This is a good level of species richness for a 1 ha remnant.

- The cover and frequency of exotic species at the subject site is relatively low away from edges and a central disturbed area (accumulated soil and log piles created by clearing event). Within quadrats 1 and 2 (SIS) only one exotic African Love Grass *Eragrostis curvula* was recorded.

- Vegetation at the subject site is bounded by industrial development and Lyn Parade although functional connectivity is likely with native vegetation across Lyn Parade and extending down to the Maxwell's Creek corridor. Connectivity exists for all mobile fauna including birds, bats and insects and some movement of reptiles and mammals is also be expected.

Both SGTF and CRCIF are highly restricted and threatened in western Sydney associated with Tertiary alluvium. Within the Liverpool LGA, SGTF is restricted to the Holsworthy, Prestons and Kemps Creek areas with a total area of c. 680 ha remaining in reasonable condition in 2012 (LBMP 2012) with only 17% (122 ha) with any planning protection. CRCIF is predominantly restricted to the Holsworthy, Voyagers Point and Kemps Creek areas with a total area of c. 220 ha remaining in reasonable condition in 2012 (LBMP 2012) and with 29% (63 ha) with any planning protection. The area of CRCIF with planning protection significantly declined from 99 ha to 63 ha between 2002 and 2012 (LBMP 2012). These figures are now several years old and further decline is expected.

Acacia pubescens

Population sizes and habitat areas provided in the SIS are incorrect (OEH 2017). The following summary is based on the best information available.

Table 1: *Acacia pubescens* – summary of population size, available habitat & % impact

Location	Population size (stems)	Area of habitat (approx.)	Impact %
Subject site	84 (SIS) 171 (Eco Logical)	0.9 ha	100%
Local population (subject site & Lot 11 on other side Lyn Parade. (DP1228445)	171 + *150 = 321	4 ha	53%
Study area (SIS)	321 + 240? = 561	37 ha (SIS) – overestimate (OEH)	30%
Locality (5 km radius of site)	No reliable figures	1342 ha (SIS) 438 ha (OEH)	Unreliable

*150 – number of *Acacia pubescens* within Lot 11 based on Humphries (2017)

The population in the study area is significant at a local and regional level and is one of only three significant populations in the locality none of which are known to be in formal conservation reserves (OEH 2017). It occurs within the geographical area of a Key Management Site (Bankstown-Liverpool) for *Acacia pubescens* (OEH Save Our Species Project).

The number of plants and area of habitat associated with the local population is significantly high relative to other known populations. Of the 116 populations identified by the recovery plan, only 24 were known to have greater than 100 stems and > 50% of populations had <20 stems (OEH 2017). Secure, or semi-secure, management regimes are only known to be in-place for about 14

populations (not the 29 populations stated in the SIS) and few of these are located in the same part of the region as the study area (OEH 2017).

4.3 Impact assessment

The level of impact of a development will largely depend on the scale of assessment. The 7-part test requires assessment at the local scale, impacts on *a local occurrence* of an ecological community and a *local population* of a threatened species.

These terms are defined in the *Threatened Species Assessment Guidelines* (DECC 2007) below.

The local occurrence

Local occurrence – the ecological community that occurs within the study area (the subject site and any additional areas which are likely to be affected by the proposal directly or indirectly). It may include adjacent areas if the ecological community on the study area forms parts of a larger contiguous area of that community and the movement of individuals and exchange of genetic material across the boundary of the study area can be clearly demonstrated.

Local population – individuals occurring within the study area (the subject site and any additional areas which are likely to be affected by the proposal directly or indirectly). It may include a cluster of individuals that extend into adjoining habitat that could reasonably be expected to be cross-pollinating with those in the study area.

The EEC(s) present at the subject site are separated from bushland to the west by Lyn Parade, a secondary road within the industrial estate. Movement of more mobile fauna between the remnants including birds, bats, mammals and insects is likely to occur facilitating important ecosystem services including pollination and seed dispersal maintaining genetic diversity within plant populations. Removal of all vegetation on the subject site will reduce this level of genetic interchange and remove some foraging and refuge habitat particularly for the closest remnant. In recognition of this connectivity it is appropriate to extend the local occurrence to the eastern end of the remnant on the opposite side of Lyn Parade (c. 0.5 ha) although the vegetation appears to have a stronger Castlereagh influence (see Annexure 4). With increasing distance and change in vegetation type the likelihood of genetic and other connectivity is reduced.

Table 2: Impact assessment of EEC relative to scale of assessment

Scale	Area based on local occurrence as per 7-part test	SIS extent	Impacts
Shale Gravel Transition Forest - Cooks River/Castlereagh Ironbark Forest			
Subject site	Lot 10, 0.9 ha	Lot 10, 0.9 ha	Agreed significant impact at 100%
Local occurrence	Lot 10 & potentially eastern section of Lot 11 (DP1228445) on other side of Lyn Parade (c. 1.4 ha) but more ironstone influence & greater number of Castlereagh species	Not identified separate from the study area	At least 65% impact = significant impact
Study area	Area as shown in figure 2.1 of SIS	Area of bushland c. 40 ha (see figure 2.1 of SIS) • Includes >1 EEC and non-contiguous areas • Indirect impacts on other remnants not demonstrated	5% based on SIS study area Insignificant impact

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The SIS fails to identify a local occurrence as defined in the guidelines. Assessment is undertaken at a broader scale presumably to diminish the level of impact. It has not been demonstrated, as is required if they are part of the local occurrence, that impacts are likely to occur on all the remnants included within the broader study area.

The indirect impacts as identified in 5.1 of the SIS are fragmentation, edge effects alteration to hydrological regimes and increased sedimentation and erosion. There will be no fragmentation resulting from the proposal, edge effects will not occur as all vegetation is to be removed and any alteration to hydrological regimes would be very limited with no defined drainage line evident within the site and hydrological separation from many of the remnants. Indirect impacts that may occur are associated with reduction in local extent of the EEC. The outcome of this broader assessment is shown in table 2.

Furthermore, the 7-part test determines the significance of impacts on a local occurrence of one specific community. The approach taken by the SIS is inclusive of several different communities (see Table 4.1 of SIS).

Acacia pubescens

The total number of *Acacia pubescens* plants recorded from the site is 171 including 101 mature plants, 11 senescent plants and 59 seedlings/regrowth. All these will be cleared in the proposal.

Acacia pubescens at the subject site are part of a local population (comprising the subject site and part of Lot 11 on other side of Lyn Parade) totalling c. 320 stems. It can be reasonably expected that cross-pollination is occurring between plants at the subject site are those in Lot 11. Pollination is predominantly by insects (bees, wasps, beetles) and birds, and seed dispersal by ants over only a few metres. The highest densities occur within the subject site (Figure 4.3 of SIS). The test of significance requires assessment of impacts on this *local population.* Loss of c. 171 plants or 53% of the local population is considered a significant impact (table 1).

Contention 2 - Impact on Environmentally Significant Land

The DA should be refused because the proposed removal of vegetation from land identified pursuant to the Liverpool Local Environmental Plan (LLEP 2008) as "Environmentally Significant Land" is inconsistent with the requirements of the LLEP 2008 and the requirements of Part 1 of the Liverpool Development Control Plan

(a) The site the subject of these proceedings is identified on the Environmentally Significant Land Map pursuant to LLEP 2008.

(1) Clause 7.6 of LLEP 2008 states that the objectives of the clause are to:
- *(a) Maintain bushlands, wetlands and wildlife corridors of high conservation value*
- *(b) To identify areas of significance for revegetation to connect to or buffer bushlands, wetlands and wildlife corridors*
- *(c) To protect rare and threatened native flora and fauna*
- *(d) To ensure consideration of the significance of vegetation, the sensitivity of the land and the impact of development on the environment prior to the giving of any development consent*

(2) Before determining an application to carry out development on environmentally significant land, the consent authority must consider such of the following that are relevant

(a) The condition and significance of the vegetation on the land and whether it should be substantially retained in that location
(b) The importance of the vegetation at that particular location to native fauna
(c) The sensitivity of the land and the effect of clearing

Under (1) the sub-clauses a, c and d are most relevant. Under (2) sub-clauses a and b are the most relevant.

The subject site is mapped as Environmentally Significant Land (ESL) in the LLEP (2008). The ESL layer has been informed by both regional and local studies including NPWS Western Sydney Vegetation Mapping (Tozer 2002), The Sydney Metro Vegetation Mapping (OEH 2008, 2013), the Liverpool City Council Biodiversity Strategy (LLC 2003) and the Liverpool Biodiversity Management Plan (LCC 2012). It includes areas identified as regional core, local core, support for core, core urban remnant, riparian corridors, regional connectivity, watercourses and wetlands based largely on condition, patch size and connectivity as developed by Eco Logical Australia in the 2003 Biodiversity Strategy. The subject site has been identified as ESL based on its classification as *Regional Core Land.* It qualifies as follows:

- an endangered ecological community (SGTF is also critically endangered at national level);
- in moderate to good condition;
- patch size of > 10 ha – the site is sufficiently connected to remnants to the west and along Maxwell's Creek (note the BBAM [OEH 2014] definition for patch size requires any gap to be <100 m from similar condition vegetation)

As regional core land the subject site is considered significant to achieving regional and local conservation management goals. The suggestion in Humphries (2017) that the conservation value of the subject site has diminished sufficiently to no longer be considered of high conservation value is unsupported.

The key objectives of Clause 7.6 are to protect bushland, high conservation land and threatened flora and fauna. Removal of this vegetation will impact on conservation management goals within the Liverpool LGA. Ecological community conservation targets in the LBMP (2012) for the relevant EEC's are summarised in the table below. The results indicate that for both SGTF and CRCIF the extent of good condition vegetation in planning protection is declining and below 2008 targets, particularly for Cooks River Castlereagh Ironbark Forest. Further clearing at the subject site will continue this cumulative decline in extent of good condition vegetation and level of protection.

Table 3: Conservation targets and results for Shale Gravel Transition Forest (SGTF) and Cooks River Castlereagh Ironbark Forest (CRCIF) from Liverpool Biodiversity Management Plan 2012

Vegetation community	Targets to be met by 2008			Results			
	Extent good condition 2003	Extent good condition by 2008	Extent good condition in planning protection by 2008	Extent good condition 2007	Extent good condition in planning protection 2007	Extent good condition 2012	Extent good condition in planning protection 2012
SGTF	682 ha	720 ha	50%	683 ha	122 ha 17%	683 ha	117 ha 17%
CRCIF	177 ha	190 ha	50%	220 ha	99 ha 45%	213 ha	63 ha 29%

The site is also of high conservation significance for a local population of *Acacia pubescens* as discussed under Contention 1. In the absence of adequate survey, it should be assumed that the large Cumberland Land Snail is also present at the site and potentially *Marsdenia viridiflora* subsp. *viridiflora* depending on the success of re-establishment measures.

(b) *The property (Lot 10 DP 1003837) is also subject to a s88B restriction which states that land is subject to a conservation management plan and that development of the site is prohibited in perpetuity. The 88B instrument was created over the property title to offset the vegetation lost during the development of the industrial area and was a requirement of DA-780/1998. The varying or removal of the restriction is not supported by the Respondent, have regard to the significance of the vegetation on site.*

The s 88B restriction on the land has afforded protection since 1999 for both the EEC and *Acacia pubescens*. The importance of this protection is now even greater in view of the development and loss of bushland that has occurred within the study area (Figure 2 of Humphries 2017), across the LGA and regionally. The high conservation significance of the site has been discussed under Contention 1 and Contention 2 (a). The conservation significance of the site is commensurate with Environmentally Significant Land as identified in the LLEP (2008) and the Section 88B restriction.

Offsetting the offset is considered inappropriate due to the high conservation significance, impacts on a local occurrence of the EEC and a local population of *Acacia pubescens*, and lack of consistency with the OEH principles for the use of biodiversity offsets (Annexure 3). Protecting vegetation at the site is also important at a regional scale as located within the OEH Save our Species Bankstown-Liverpool key management site for *Acacia pubescens* (OEH 2017b) and in protecting the regional extent of SGTF/CRCIF, close to its southern limit. The reasons for applying the restriction in 1999 are still valid. The conservation area was retained *to preserve a small but naturally functioning ecosystem that has special conservation significance* (Thomas PoM, Section 1). It is unfortunate that Council could not legally require the land be dedicated to Council (NPWS 1999) and that the long-term intentions of the Conservation Management Plan have not been honoured. The current lack of management, however, is not a credible reason for clearing of the site.

The proposed removal of all vegetation from the site will result in loss of habitat for local fauna and particularly the disruption to avifauna habitation patterns for the area.

The loss of 0.9 ha of fauna habitat will result in the loss or displacement of some fauna species, particularly non-mobile species such as the Cumberland Plain Land Snail which has a very small home territory. There will be loss of refuge habitat in the event of fire in adjoining or other local remnants. Pressure will generally increase on the adjoining remnants for foraging and breeding habitats and resources, including avifauna (birds), bats, insects, reptiles, small mammals etc. This in turn can impact on important ecosystem processes such as pollination. These cumulative impacts are rarely considered but can be significant. Thresholds for significant loss of species are poorly understood.

(c) *Having regard to the matters raised in Contention 1, the environmental significance of the site and the existence of the s 88B restriction on the property, the DA is not consistent with the objectives and controls in clause 7.6 of LLEP 2008 and should be refused.*

I agree the DA is not consistent with the objectives and controls in clause 7.6 of LLEP 2008. The site contains bushland of high conservation value including threatened native flora and fauna that will be completely cleared. The importance of the vegetation in that particular location (i.e.

the subject site) is an important consideration for the consent authority. The geographical location of the EEC is important (restricted distribution and close to southern limit) and for *Acacia pubescens* due to a high density of plants in comparison to other remnants. The effect of clearing on adjoining remnants also requires consideration (see discussion under (c)).

(d) *The proposed development is also inconsistent with the aims in clause 1.2(2)(g) and (h) and clause 5.9 of LLEP 2008 and the following provisions of Part 1 of Liverpool DCP 2008:*

1.2 (2)

(*g) to conserve, protect and enhance the environmental and cultural heritage of Liverpool,*

(h) to protect and enhance the natural environment in Liverpool, incorporating ecologically sustainable development

The subject land has been mapped as ESL in the LLEP (2008) and as Core Regional land in the Liverpool Biodiversity Management Plan (2012), and contains threatened species. Accordingly, the site is a priority for protection. Removal of all vegetation will result in 100% development of the original property Lot 1, D.P. 626996, and at the subject site. This is completely inconsistent with the aims of conserving, protecting and enhancing the environmental heritage of Liverpool or with ecologically sustainable development.

Clause 5.9 has been repealed.

Part 1 of Liverpool DCP 2008

a. *Section 3: Landscaping and incorporation of existing trees, namely the objectives of Section 3 and the controls in 3.1; and*
b. *Section 4: Bushland and Fauna Habitat Preservation, namely the objectives and controls in Section 4.*

Objectives of Section 3 aim to maintain biodiversity within the urban landscape for ecological and environmental reasons as well as aesthetics and climate modification. The retention of as many existing trees and associated habitat as possible within the development site is a key objective in achieving this outcome. There is no provision in the development proposal to retain any existing trees or habitat and therefore is inconsistent with Section 3 and the controls of 3.1.

Objectives of Section 4 aim to maintain bushland within the urban landscape to protect and enhance the natural heritage of Liverpool including biodiversity and natural ecology while also maintaining or improving amenity and scenic qualities. The controls require that bushland identified as a threatened community or habitat for a threatened species shall be substantially retained and incorporated into the development. Clearing of all vegetation at the site is completely inconsistent with these objectives and controls. Development should also not adversely impact on long-term viability of bushland or existing fauna corridors. Loss of bushland at the subject site will increase cumulative impacts on an adjoining remnant and others in the study area, and reduce the extent of an existing fauna corridor.

ANNEXURES

Annexure 1 – References
Annexure 2 – Teresa James CV
Annexure 3 – OEH principles for the use of biodiversity offsets in NSW
Annexure 4 – Figures 1 & 2
Annexure 5 – Draft Management Plan for Conservation Zone

ANNEXURE 1 - REFERENCES

Australian Government, Dept. of Environment & Energy (3 Feb 2017) letter to Liverpool City Council

Cumberland Ecology (Sept 2016) Species Impact Statement for Timpag Investments Pty Ltd

Cumberland Plain Land Snail – profile NSW Environment & Heritage

DEC (2004) Threatened Biodiversity Survey & Assessment Guidelines

DEEC (2007) Threatened assessment guidelines – The assessment of significance

Doherty, M. (1998) The Conservation Value of Regrowth Native Plant Communities – A Review Report to the NSW Scientific Committee

Humphries, R. Eco Logical Australia (Dec 2017) Expert Statement – Response to Facts and Contentions - Timpag Investments v Liverpool City Council, Land & Environment Court 2017/00234018

Liverpool City Council LCC (May 1999) Notice to Applicant of determination of a development application for Lot 1, D.P. 626996.

Liverpool Local Environment Plan (LLEP) 2008 and Development Control Plan (DCP) 2008

Liverpool Biodiversity Management Plan LBMP (2012)

Michael Brown Planning Strategies (2016) Statement of Environmental Effects SEE

NPWS (May 1999). Proposed Industrial Subdivision, Lot 1 DP 626996, 42 A Jedda Road Prestons. Letter to Mr Brian Carr, Liverpool City Council

NPWS (2003) *Acacia pubescens* Recovery Plan

NSW Scientific Committee (2002) Cooks River Castlereagh Ironbark Forest endangered ecological community listing

NSW Scientific Committee (2012) Shale Gravel Transition Forest endangered ecological community listing

OEH (2013) The Native Vegetation of the Sydney Metropolitan Area

OEH *Principles for the Use of Biodiversity Offsets in NSW*
http://www.environment.nsw.gov.au/biodivoffsets/oehoffsetprincip.htm

OEH (2014) BBAM BioBanking Assessment Methodology

OEH (27/2/2017) Comments on SIS for 36 Lyn Parade Prestons, letter to Ivan Kokotovic LCC Council

OEH (2017b) Saving our Species (SoS) project summary for *Acacia pubescens*

Thomas, D. for Lesryk Environmental Consultants (Aug 1998) Species Impact Statement for *Acacia pubescens* and *Meridolum corneovirens* at proposed industrial development site,42A Jedda Road, Prestons

Thomas, D. (undated) Draft Management Plan for Lot 10, 42A Jedda Road, Prestons

Tozer, M. (2003) The native vegetation of the Cumberland Plain, western Sydney: systematic classification and field identification of communities. *Cunninghamia* 8(1):1-75

ANNEXURE 2 - *Curriculum Vitae*: Teresa Ann James

Home & work address: 835 Caparra Road, Caparra NSW 2429.

Telephone: 02 6550 7311. Mobile: 04 282 18502.

Email: t.james@optusnet.com.au

Key positions:

- Botanist/ecological consultant specialising in vegetation survey, plant identification, conservation assessment and threatened species.
- Until October 1998 held position of Identifications Botanist, Plant Sciences, National Herbarium of New South Wales, Royal Botanic Gardens, Sydney.

Qualifications:
Bachelor of Science (Combined Honours in Biology and Geography) - University of Exeter, England. 1978.

Accreditation:
Accreditation awarded (2008) as a BioBanking Assessor under the Threatened Species Conservation Act 1995 (NSW); accreditation renewed 2013. Accreditation number 0017.

Current employment (1998-present):
Self- employed flora/ecological consultant (sole trader working as Teresa James Flora Consultant).

- Flora surveys, site/conservation assessments and monitoring projects.
- Preparation of environmental impact assessment reports (e.g. 7-part test, species impact statement & review of environmental factors).
- Biobanking and Biodiversity Offset assessments.
- Preparation of threatened species management plans.
- Expert witness in the Land & Environment Court.
- Botanical training for local councils and community groups.

Previous employment

1978 (3 months)	Technical Assistant, Biological and Chemical Research Institute, Rydalmere (Department of Agriculture).
1978-1998	Employed at the Royal Botanic Gardens, Sydney.
1978-1979	Temporary Herbarium Assistant
1980-1982	Technical Officer, Botanical Information Section
1982-1986	Acting Identifications Botanist, Botanical Information Section
1987-1991	Technical Officer, Botanical Information Section
1991-1994	Acting Identifications Botanist, Botanical Information Section
1994	Secondment 4 days/week to World Heritage Assessment of the Blue Mountains (consultancy for NSW National Parks & Wildlife Service).
1994	Permanent appointment as Identifications Botanist.
1994-	Appointed Botanical Information Section Co-ordinator.
1996-1997	Secondment to NSW National Parks & Wildlife Service as Flora Officer for Urban Bushland Biodiversity Survey. Stage 1: Western Sydney.
1994-1998	Identifications Botanist & Botanical Information Section Co-ordinator.

<u>Selected longer-term projects:</u>

1998-1999	Vegetation sampling for NSW National Parks & Wildlife Service - Western Sydney Vegetation Mapping Project.
1999	Flora consultant to Eastern Gas Pipeline (Duke Australia Operations).
2000	Preparation of Fire Ecology Manual for Rural Fire Service and UWS.
October 2000-2003	Flora consultant to Biosis Research for Penrith City Council – proposed developments & TSC Act issues at Erskine Park.
2001	Field sampling and truthing for vegetation community mapping project - Baulkham Hills LGA. Baulkham Hills Shire Council.
2001-2003	Qualitative and quantitative vegetation surveys (including rare plant species and ecological communities, weeds and other threats, environmental assessment) of Wingecarribee Swamp with Sainty & Associates for the Sydney Catchment Authority.
February 2002-May 2002	Review of wetland boundaries and general vegetation mapping and condition assessment within Baulkham Hills local government area (for Baulkham Hills Shire Council).
2003	Vegetation survey in the Hunter, Nattai & Bargo districts as part of the National Parks & Wildlife Service Vegetation Survey Program.
2002-2007	Flora survey/monitoring at Dr Charles McKay Reserve, Mt. Druitt for Blacktown City Council.
September 2005 –2006	Field validation for Foreshore Vegetation Mapping Project on Sydney Harbour for Botanic Gardens Trust and NSW Maritime Services.
September 2000-2008	Flora consultant to Liverpool City Council – provide review & advice relating to development applications, plans of management & special projects.
February -May 2007	Field survey for Sydney Metropolitan Catchment Management Authority/DECC vegetation mapping. Plot data recorded for 100 sites within SMCMA.
May 2008-2010	Vegetation mapping and assessment of Blue Gum High Forest and Turpentine Ironbark Forest in Ku-ring-gai local government area
August 2008-present	Flora advice to Ku-ring-gai Council - review of development applications, plans of management and mapping/biodiversity projects.
February-August 2012	PAS2 Expert Interviews for NSW threatened species with Office of Environment & Heritage.

*See consultant reports for complete list of projects/surveys.

Special projects:

<u>Assessment of the World Heritage Values of the Blue Mountains and surrounding plateaus</u>

An assessment of the natural and cultural values of the sandstone plateaus of the Blue Mountains and surrounding areas was funded by the Federal and State Governments to determine the potential for world heritage nomination. A team of people worked on the project from the Royal Botanic Gardens, Australian Museum (cultural values) and experts from local universities. I was project co-ordinator for the assessment, wrote much of the text for the natural values sections and was editor of the final report. This report was used as a basis for the successful Blue Mountains World Heritage nomination (June 1998).

<u>NPWS Urban Bushland Biodiversity Survey. Stage 1: Western Sydney</u>

Documentation of biodiversity and conservation values in Western Sydney was the first priority project undertaken within the State Biodiversity Survey Program. The survey gave emphasis to threatened species, communities and

habitats. The region was documented on a local government area basis. I co-ordinated the flora surveys and was principal author for the flora reports.

Particular expertise:

Plant Identification:

- New South Wales plants, native and naturalised (18 years of experience in the Botanical Information Section of the Royal Botanic Gardens, Sydney). Specimens received from all over state. Also cultivated plants.
- Specialist in Sydney flora.
- Prepared taxonomic treatments for various plant families in the publication Flora of New South Wales, volumes 1-4, produced by the Royal Botanic Gardens, Sydney.
- Conduct plant identification workshops both through the RBG and the University of Western Sydney.

Documentation and conservation/ impact assessment: plant communities and species

- Extensive range of sites surveyed with species lists compiled over the last twenty-five years, particularly in Western Sydney, the Blue Mountains and Southern Highlands. Plant specimens collected and incorporated into the National Herbarium of N.S.W. Information used in numerous reports and books e.g. World Heritage Assessment of the Blue Mountains, the NPWS Urban Bushland Biodiversity Survey, Rare Bushland Plants of Western Sydney and various papers.
- Prepare Tests of Significance and Species Impact Statements as required under current legislation (TSC Act, EPBC Act).
- Prepare Statements of Evidence & Affidavits for the Land & Environment Court.
- Provide advice to the community, developers, government agencies and councils concerning the identification of communities and species, impacts of proposed developments, the ecological effects of urbanisation, flood mitigation and management practices such as mowing, burning etc.

Education & training

- Involvement on committees or in groups providing technical advice and training eg. Greystanes Creek Management Committee, Upper Parramatta River Catchment Trust steering committees, Hawkesbury Rainforest Network.
- Presentations/talks e.g. National Parks Association, Society of Australian Plants, University of NSW, Landcare groups, local councils.
- Conduct plant community and species identification workshops/courses/tours through the Royal Botanic Gardens, the University of Western Sydney and privately.
- Prepared Fire Ecology Manual for Rural Fire Service (2000).
- Training for local government in threatened species, endangered ecological communities and biodiversity conservation.
- Publications e.g. primary author of revised edition of Rare Bushland Plants of Western Sydney (Royal Botanic Gardens 1999*),* contributor to Flora of New South Wales *(*Royal Botanic Gardens).

Courses/workshops & tours provided to local government/catchment management trusts/consultancies 2004 – present. Examples:

- Sept. 2004 - Threatened Species Tour for Baulkham Hills Shire Council bush care workers & council staff
- October 2004 – Significant Plant Communities-of Baulkham Hills Shire Council – tour for council staff
- February 2005 – Community workshop in Cumberland Plain Woodland for Holroyd City Council
- July-August 2005 - Biodiversity training for Liverpool City Council – 3 workshops for council officers
- November 2008 to April 2009 – Weedy Grass Identification Workshop x 3 for Sydney Metro CMA.
- October 2009 – EEC identification field day for Hawkesbury-Nepean CMA
- October 2010 – Cumberland Plain Woodland identification training for SMEC Australia
- April 2011 – Field training in identification of communities & plants on the Cumberland Plain for Hawkesbury Nepean CMA.
- June 2011 – Presentation to council staff on threatened flora & fauna and biodiversity conservation within the Hills Shire.
- June 2012 – Eucalypt Identification workshop for Hills Shire Council.

- September – November 2014 – Series of two-day workshops on threatened ecological communities in western Sydney.
- October 2014 – Plant identification training day held at Dr Charles Mckay Reserve, Mt. Druitt for Blue Tongue Ecosystems.
- March 2015 – Derived Grasslands Workshop (western Sydney) for government and community.
- May 2015 - Threatened Ecological Communities Workshop (western Sydney) for government and community.
- August 2015 – Shale Sandstone Transition Forest Workshop (western Sydney) for government and community.
- September 2015 – Northern Sydney Threatened Communities Workshop for government and community.
- April 2016 – Introduction to Identifying Western Sydney Plants
- April 2016 – Grass Identification Workshop
- April 2016 – Cumberland Plain Woodland Workshop for Liverpool Council bushcarers
- August 2016 - Threatened Species Tour for Hills Shire Council.
- April 2017 – Bushcare Training for Penrith Council
- Aug-Sept -Oct 2017 - Community bushland guided walks for Liverpool Council
- August 2017 - Threatened Species Tour for Fairfield City Council.
- August 2017 - Threatened Species Tour for Hills Shire Council.
- September 2017 – Flora workshops at Scheyville and Agnes Banks

Committee & community participation

- Member of NPWS Cumberland Plain Woodland Recovery Team (1998).
- Member of NPWS Acacia pubescens Recovery Team (1998 to 2002).
- Member, Green Corridors Strategy Steering Committee.Upper Parramatta River Catchment Trust. (1997-2000).
- Member, Water Quality Strategy Steering Committee. Upper Parramatta River Catchment Trust (1995-7).
- Member, State of the Environment Report Steering Committee for Holroyd City Council (1995-2002).
- Botanical Advisor for Management Committee, Greystanes Creek Restoration Project (1993-2000).
- Blue Gum High Forest Workshop / Advisory Committee – Ku-ring-gai Council. (2007).

Publications/booklets:

- Stepnell, K. & James, T. A. (1986). *Australia's Native Flowers*. Child & Henry Publishing Pty. Ltd.
- James, T.A. (1988). *Bertya ingramii* (Euphorbiaceae) a new species from New South Wales. *Telopea* 3(2): 285.
- Bedford, D. & James, T. (ed.) (1992). *Collection, Preparation & Preservation of Plant Specimens.* Royal Botanic Gardens, Sydney.
- Powell, J.M. & James, T.A. (1993) *Epacris sparsa* (Epacridaceae) reinstated. *Telopea* 5(2):375-380.
- James, T.A. (1990-1993) in *Flora of New South Wales*. Royal Botanic Gardens, Sydney
- Volume 1: Euphorbiaceae (part), Violaceae.
- Volume 2: Fabaceae (part).
- Volume 3: Celastraceae, Rubiaceae (part).
- Volume 4: Iridaceae (part), Poaceae (part).
- James, T.A. (1994). Observations on the effects of mowing on native species in remnant bushland, Western Sydney. *Cunninghamia* 3(3).
- Kodela, P.G. & James, T.A. & (1994) Aspects of the ecology and conservation status of the rare herb *Gentiana wingecarribiensis*. *Cunninghamia* 3(3).
- James, T.A. (1994) Review of a Key to Australian Grasses by B.K. Simon. *Australian Systematic Botany Society Newsletter* No.78.
- Contributor to Bowen Mountain Bushwalks (1994). Bowen Mountain Association.
- Kodela, P.G, James, T.A & Hind, P. (1996). Vegetation and flora of swamps on the Boyd Plateau, Central Tablelands, New South Wales. *Cunninghamia* 4(3).
- James, T.A. (1996). New combination in *Viola* (Violaceae). *Muelleria* Vol. 9 pp.35-36.
- James, T.A. NSW NPWS. (1997). Urban Bushland Biodiversity Survey. Stage 1: Native flora in Western Sydney.

- Hosking, R. J & James, T.A. (1998). An analysis of the native and exotic flora of the North Western Slopes upstream of the junction of the Peel and Namoi Rivers, New South Wales.
- James, T.A., McDougall, L & Benson, D. (1999). Revised edition. *Rare Bushland Plants of Western Sydney.* Royal Botanic Gardens, Sydney.
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- James, T.A. (2009) Vegetation communities of Baulkham Hills Shire – unpublished booklet for Baulkham Hills Shire Council.
- James, Teresa (2013) Flora of Cumberland Plain Woodland – an identification guide.
- James, Teresa (2015) Threatened Flora of the Fairfield LGA.
- James, Teresa (2016) Native Flora of Shale Soils of the Cumberland Plain Woodland – An Identification Guide.

Reports
List of unpublished species lists and reports over the last 15 years.

- Kodela, P.G., James, T.A., Coveny, R.G. and Hind, P.D. (1992). Reconaissance survey of the vegetation at Long Swamp, near Penrose, Central Tablelands, N.S.W. Royal Botanic Gardens, Sydney. Unpublished report.
- James, T.A. & Kodela, P.G. (1992). Species list for Little Cattai Creek and tributary creeks. Royal Botanic Gardens, Sydney. Unpublished species list.
- James, T.A. & Kodela, P.G. (1993). Plant species recorded from Butlers Swamp, Central Tablelands, N.S.W. Royal Botanic Gardens, Sydney. Unpublished species list.
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- Allen, CB, Benson, DH, James, T & Kelleway, J (2007). Vegetation map of the Sydney Harbour Foreshore, December 2006. Prepared for NSW Maritime and the Sydney Metropolitan CMA by Royal Botanic Gardens, Sydney.

Consultancies 1992 -present, last 10 years provided below:

- February-May 2007. Field survey of Sydney Metropolitan Catchment Management Authority area. Royal Botanic Gardens Trust and Sydney Metropolitan Catchment Management Authority.
- T.A. James (February 2007). Faulkland Crescent Reserve - flora survey and review. Report to Blacktown City Council.
- James, T.A. (April 2007). Upgrade of Great Western Highway at Wentworth Falls - proposed stockpile, compound and spill basin areas - Flora survey and assessment. Report to Australian Museum Business Services for RTA.
- James, T.A. (May 2007). Upgrade of Great Western Highway at Bullaburra – flora survey and assessment. Report to Australian Museum Business Services for RTA.
- BioBanking Pilot Program (May 2007). Field survey & assessment at three Sydney sites (Wilton, Camden & Cranebrook) to test draft assessment methodology. Undertaken with Australian Museum Business Services for Department of Environment & Conservation.
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- James, T.A. & C. H. Barker (October 2007). Flora & Fauna Survey and Assessment – Castle Hill Cemetery. Report to Baulkham Hills Shire Council.
- James, T. A. (Nov 2007). Investigation of clearing of native vegetation at Lot 2 DP 559922, 280-282 Captain Cook Drive, Kurnell. Report to NSW Department of Environment & Climate Change (DECC).

- James, T.A. (Nov 2007). Review of flora assessment for proposed residential development at 216-220 New Line Road, Dural. Report to Hornsby Council.
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ANNEXURE 3: OEH principles for the use of biodiversity offsets in NSW

These principles have been developed by the Office of Environment and Heritage (OEH) to provide a useful framework when considering biodiversity impacts and appropriate offset requirements.

They are intended to be used for proposals other than those for state significant development (SSD) or state significant infrastructure (SSI). A **Biodiversity Offsets Policy for Major Projects** has been developed to deal with proposals for SSD and SSI.

1. Impacts must be avoided first by using prevention and mitigation measures.

Offsets are then used to address the remaining impacts. This may include modifying the proposal to avoid an area of biodiversity value or putting in place measures to prevent offsite impacts.

2. All regulatory requirements must be met.

Offsets cannot be used to satisfy approvals or assessments under other legislation, such as assessment requirements for Aboriginal heritage sites and for pollution or other environmental impacts (unless specifically provided for by legislation or additional approvals).

3. Offsets must never reward ongoing poor performance.

Offset schemes should not encourage landholders to deliberately degrade or mismanage offset areas in order to increase the value from the offset.

4. Offsets will complement other government programs.

A range of tools is required to achieve the NSW Government's conservation objectives, including the establishment and management of new national parks, nature reserves, state conservation areas and regional parks, and incentives for private landholders.

5. Offsets must be underpinned by sound ecological principles.

They must:

- include the conservation of structure, function and compositional elements of biodiversity, including threatened species
- enhance biodiversity at a range of scales
- consider the conservation status of ecological communities
- ensure the long-term viability and functionality of biodiversity.

Biodiversity management actions, such as enhancement of existing habitat and securing and managing land of conservation value for biodiversity, can be suitable offsets. Reconstruction of ecological communities involves high risks and uncertainties for biodiversity outcomes and is generally less preferable than other management strategies, such as enhancing existing habitat.

6. Offsets should aim to result in a net improvement in biodiversity over time.

Enhancement of biodiversity in offset areas should be equal to or greater than the loss in biodiversity from the impact site.

Setting aside areas for biodiversity conservation without additional management or increased security is generally not sufficient to offset the loss of biodiversity. Factors to consider include protection of existing biodiversity (removal of threats), time-lag effects, and the uncertainties and risks associated with actions such as revegetation.

Offsets may include:

- enhancing habitat
- reconstructing habitat in strategic areas to link areas of conservation value
- increasing buffer zones around areas of conservation value
- removing threats by conservation agreements or reservation.

7. Offsets must be enduring – they must offset the impact of the development for the period that the impact occurs.

As impacts on biodiversity are likely to be permanent, the offset should also be permanent and secured by a conservation agreement or reservation and management for biodiversity. Where land is donated to a public authority or private conservation organisation and managed as a biodiversity offset, it should be accompanied by resources for its management. Offsetting should only proceed if an appropriate legal mechanism or instrument is used to secure the required actions.

8. Offsets should be agreed prior to the impact occurring.

Offsets should minimise ecological risks from time-lags. The feasibility and in-principle agreements to the necessary offset actions should be demonstrated prior to the approval of the impact. Legal commitments to the offset actions should be entered into prior to the commencement of works under approval.

9. Offsets must be quantifiable – the impacts and benefits must be reliably estimated.

Offsets should be based on quantitative assessment of the loss in biodiversity from the clearing or other development and the gain in biodiversity from the offset. The methodology must be based on the best available science, be reliable and used for calculating both the loss from the development and the gain from the offset. The methodology should include:

- the area of impact
- the types of ecological communities and habitat or species affected
- connectivity with other areas of habitat or corridors
- the condition of habitat
- the conservation status and/or scarcity or rarity of ecological communities
- management actions
- level of security afforded to the offset site.

The best available information or data should be used when assessing impacts of biodiversity loss and gains from offsets. Offsets will be of greater value where:

- they protect land with high conservation significance
- management actions have greater benefits for biodiversity
- the offset areas are not isolated or fragmented
- the management for biodiversity is in perpetuity, such as secured through a conservation agreement.

Management actions must be deliverable and enforceable.

10. Offsets must be targeted.

They must offset impacts on the basis of like-for-like or better conservation outcomes. Offsets should be targeted according to biodiversity priorities in the area, based on the conservation status

of the ecological community, the presence of threatened species or their habitat, connectivity and the potential to enhance condition by management actions and the removal of threats.

Only ecological communities that are equal or greater in conservation status to the type of ecological community lost can be used for offsets. One type of environmental benefit cannot be traded for another: for example, biodiversity offsets may also result in improvements in water quality or salinity but these benefits do not reduce the biodiversity offset requirements.

11. Offsets must be located appropriately.
Wherever possible, offsets should be located in areas that have the same or similar ecological characteristics as the area affected by the development.

12. Offsets must be supplementary.
They must be beyond existing requirements and not already funded under another scheme. Areas that have received incentive funds cannot be used for offsets. Existing protected areas on private land cannot be used for offsets unless additional security or management actions are implemented. Areas already managed by the government, such as national parks, flora reserves and public open space, cannot be used as offsets.

13. Offsets and their actions must be enforceable through development consent conditions, licence conditions, conservation agreements or contracts.
Offsets must be audited to ensure that the actions have been carried out, and monitored to determine that the actions are leading to positive biodiversity outcomes.

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http://www.environment.nsw.gov.au/biodivoffsets/oehoffsetprincip.htm

ANNEXURE 4: FIGURES 1 & 2

Figure 1: Local occurrence of the EEC (Shale Gravel Transition Forest/Cooks River Castlereagh Ironbark Forest (red outline) – adapted from figure 4.1 of SIS

Figure 2: Local population of *Acacia pubescens* (blue outline, individual records are green circles) – adapted from figure 4.3 of SIS

ANNEXURE 5 – *Plan Of Management*

MANAGEMENT PLAN FOR CONSERVATION ZONE LOT 10, 42A JEDDA ROAD PRESTONS

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CONTENTS

MANAGEMENT PLAN FOR CONSERVATION ZONE, LOT 10, 42A JEDDA ROAD, PRESTONS

1. INTRODUCTION

42A Jedda Road, Prestons is proposed to be subdivided in two stages:

- Stage 1, comprising Lots 10 (for conservation of threatened species) and 11 (residue lot)
- Stage 2, comprising the subdivision of the residue lot (Lot 11) into eight industrial lots (Lots 1-8) and one public reserve lot (Lot 9)

Liverpool City Council has given consent for the development proposal to proceed provided that specified conditions are satisfied. These included the requirement that a plan of management (PoM) be prepared and implemented for the preservation of threatened species in Lot 10 (Fig. 1).

The management plan is to include:

- a program for the salvage of *Meridolan corneovirens* from the developable area (Lot 11) and monitoring of their relocation to the conservation zone (Lot 10). The PoM must specify that any collection, reintroduction or monitoring of the species is undertaken by a suitably qualified environmental consultant who is experienced in identification of the species and its habitat requirements.

- *Senna odorata* and *Marsdenia viridiflora* are to be salvaged and reestablished in Lot 10

- a weed control program, which includes monitoring and control of weed invasion. The PoM must specify that any weed control is undertaken by a qualified bushland regenerator.

- specifications regarding ecological burns in the conservation area

- the buildings on Lot 11 shall be designed so as to minimise overshadowing of bushland in the conservation zone (Lot 10)

- the PoM must be submitted to the Manager, Threatened Species Unit, Sydney Zone, NPWS for approval prior to the release of the linen plan of subdivision.

- provide resources for 3 yrs for implem of PoM.

Other conditions of the approval relate to management of the conservation zone and are appropriate for inclusion in the PoM:

- the conservation area is to be fenced (1.8 metre-tall fence) to prevent unnecessary access
- there is to be no storage of materials, vehicles, waste or disposal of stormwater, liquid waste or rubbish of any kind on Lot 10
- no fire protection activities are to occur within the conservation area, All fire protection activities, as required, are to occur outside this area, and may be carried out in the buffer zone on Lot 11.

This Plan of Management has been prepared in order to satisfy the above requirements of the Development Application approval. The general aim of the requirements is to permanently preserve a small example of a naturally functioning ecosystem that has special conservation significance. The main features of this area are *Acacia pubescens* (Downy Wattle) and *Meridolan corneovirens* (Cumberland Plain Land Snail). The plant community (*Eucalyptus fibrosa* Shale/Gravel Transition Forest) is uncommon in Liverpool local government area and inadequately conserved throughout its range.

2. MANAGEMENT AREA

The management area comprises Lot 10, that has been set aside as permanent conservation zone (Fig. 1). It covers 1.0065 hectares.

The area is approximately oblong and is located about 72 metres south of Jedda Road and east of the proposed extension of Lynn Parade. Its dimensions are (clockwise from Lynn Parade, in metres) 142.775, 70.0, 144.9, 70.03, with the long axis east-west.

The site is relatively flat with no obvious drainage lines. The aspect is north-west, with a range in elevation of 28.4 to 31.8 metres above sea level.

The site and adjoining properties are zoned 4(a) Industrial.

Most of the surrounding areas in the suburb contain built environment. Land north of Jedda Road has been developed as industrial area, and land adjoining the conservation area is proposed for similar development. Residential development extends east from Wonga Road and south of Kurrajong Road. Bushland that is similar to that in the conservation zone, and grassy paddocks occur south and west of the site and along Maxwells Creek.

Geology in the site is Wianamatta Shale with fine lateritic gravel. The soil surface over most of the site has been scalped during clearing, but appears to have been a thin clay loam over deep subsoil.

Figure 1 Arrangement of Conservation Zone and Industrial Lots at 42A Jedda Road, Prestons

3. VEGETATION

3.1 Native Vegetation

Most of the vegetation was cleared by earth-moving equipment in June, 1997. This involved removal of the above-ground vegetation, but retention of most of the topsoil and below-ground plant parts.

The vegetation in the conservation zone comprised (at mid 1998) the shrubby understorey of Shale/Gravel Transition Forest (Benson, 1992). It was generally one metre in height and varied from dense to open cover. *Melaleuca nodosa* was dominant, with *Acacia pubescens* and *Bursaria spinosa* being common and widespread. Other species included: *Dillwynia sieberi*, *Indigofera australis* and a localised group of *Senna odorata* (in Lot 8). No introduced species were recorded in the tree or shrub strata, except for localised *Senna pendula* in Lot 8 (Appendix 1).

A few individual and small groups of canopy trees remained, especially near the property boundaries. The main species was *Eucalyptus fibrosa* (Broad-leaved Ironbark). A couple of individuals of *Eucalyptus sideroxylon* (Mugga Ironbark), *Eucalyptus longifolia* (Woollybutt) and *Eucalyptus tereticornis* (Forest Red Gum) were recorded. Many of the root systems of cleared trees were resprouting and likely to re-establish the previous tree canopy. Many were 1-2 metres tall in mid 1999.

Eucalyptus moluccana (Grey Box) and *Eucalyptus eugenioides* (Thin-leaved Stringybark) were recorded in nearby properties and may have previously occurred in or adjacent to Lot 10.

Melaleuca decora was the main small tree but most had been removed during the clearing, leaving a few small groups of young mature specimens and numerous shrub-sized plants. The latter were resprouting from existing rootstock of the original trees.

Most of the ground cover was removed during the clearing but had regenerated by June 1999. Typical indigenous species included *Entolasia stricta*, *Microlaena stipoides*, *Gonocarpus tetragyna*, *Dillwynia sieberi* and *Pimelea linifolia*.

Vines and mistletoes were rare to occasional at the site. Native species recorded included: *Polymera calycina* and *Glycine tabacina*. *Marsdenia viridiflora* was recorded in Lot 8 near Jedda Road.

3.2 Introduced Vegetation

Weeds dominated the log-dump areas and the 10-15 metre-wide margin of the western property boundary. Much of the latter occurred in the proposed Lynn Parade road reserve. The main species in the log dumps were *Pennesetum clandestinum*, *Phytolacca octandra*, *Solanum nigrum* and *Conyza albida*. *Eragrostis curvula* was the main species at the western margin and occurred in scattered populations in the western half of Lot 10.

3.3 Conservation Significance of Plant Communities

The native plant community is modified Shale/Gravel Transition Forest. The main alteration has been the temporary loss of natural tree cover.

The plant community type is considered by James (1997) as being "vulnerable" at national, state and regional levels, and "inadequately conserved throughout its geographical range". National Parks & Wildlife recommendations for the 100 hectares of this plant community in and adjoining the study area, and contiguous Grey Box Woodland, (James, 1997) were that they be "protected as a key biodiversity area".

Previous clearing in 1997 has partly and temporarily reduced its conservation value. The vegetation still retained a high species diversity, that was probably similar to that of undisturbed similar bushland. It is likely that a "natural" tree cover will be formed from current resprouting in about ten years' time. By June, 1999, a ground cover of mainly native species had regenerated and resprouted in locations that were previously bare. Approximately 500 square metres of sparsely covered ground remained.

3.4 Conservation Significance of Plant Species

20 plant species recorded at the site are considered to be "vulnerable" in Western Sydney (James, 1997)(Appendix 1). Three of these are regionally or nationally significant (*Acacia pubescens*, *Senna odorata* and *Marsdenia viridiflora*).

4. FAUNA

4.1 Species Recorded

17 native fauna species were identified as occurring within and adjacent to the study area. The species recorded included, 15 native birds, 1 frog, 1 snail and nine introduced species (Table 1).

Ten individuals of the Cumberland Plain Land Snail (*Meridolum corneovirens*) were found in the proposed conservation zone, and another ten were found nearby in adjoining properties in 1998 (Thomas, 1998). These were observed under ground debris and urban litter.

Table 1 Fauna recorded in and adjacent to the conservation zone

Birds	
Straw-necked Ibis	Threskiornis spinicollis
* Rock Dove	Columba livia
* Spotted Turtle-Dove	Streptopelia chinensis
Galah	Eolophus roseicapilla
Sulphur-crested Cockatoo	Cacatua galerita
Rainbow Lorikeet	Trichoglossus haematodus
Superb Fairy-wren	Malurus cyaneus
Yellow Thornbill	Acanthiza nana
Red Wattlebird	Anthochaera carunculata
Noisy Miner	Manorina melanocephala
Lewins Honeyeater	Meliphaga lewinii
Yellow-faced Honeyeater	Lichenostomus chrysops
Magpie-lark	Grallina cyanoleuca
Black-faced Cuckoo-shrike	Coracina novaehollandiae
Pied Currawong	Strepera graculina
Australian Raven	Corvus coronoides
Welcome Swallow	Hirundo neoxena
Tawny Grassbird	Megalurus timoriensis
* Common Myna	Acridotheres tristis
* Common Starling	Sturnus vulgaris
Mammals	
* House Mouse	Mus musculus
* Rabbit	Oryctolagus cuniculus
* Fox	Vulpes vulpes
* Dog	Canis familiaris
Amphibian	
Common Eastern Froglet	Crinia signifera
Mollusc	
# Cumberland Plain Land Snail	Meridolum corneovirens

No other threatened fauna species were recorded in or adjoining the conservation zone in 1998.

4.2 Habitat Available For Native Fauna Species

The habitat at the site is regenerating shrubland. Details of this community is described above in *Section 3 - Vegetation* and *Appendix 1*.

The community contains scattered urban refuse and minor depressions that contained small amounts of water after rain events. The site and adjoining area is fairly flat and contains no creeks or significant niche variations. The shrubland contains the remnants of previously cleared trees that are now resprouting. In the absence of further disturbance the shrubland is likely to eventually revert to woodland.

4.3 Value Of The Habitat For Native Fauna Species

For vertebrate fauna species, the shrubland was not considered to be of special value in mid 1998. The habitat was highly disturbed, impacted upon by weeds and urban refuse, fragmented, exposed to predators and isolated from structurally intact bushland. Few resources were observed in this area which would be of value for the life cycle needs of those species observed or potentially occurring. It is anticipated that the habitat conditions will improve as the native vegetation continues to regenerate, to close existing gaps and restore the tree canopy.

The shrubland is utilised by the Cumberland Plain Land Snail *Meridolum corneovirens*. This species was using the area for sheltering, foraging and breeding. Those individuals found were identified sheltering under urban refuse (for example old cupboards, beds, cabinet top, cardboard and so forth), presumably making use of this debris as most natural debris had been cleared and stockpiled.

5. ENVIRONMENTAL MANAGEMENT

5.1 Aim

The broad aim of this management plan is to permanently retain the conservation and aesthetic values of the natural vegetation and fauna habitat on Lot 10, 42A Jedda Road, Prestons. Special emphasis has been placed on ensuring the continuation of viable populations of *Acacia pubescens* and *Meridolan corneovirens*.

The desired outcomes that are likely to achieve this aim are:

- maintenance of natural ecological processes in the conservation area. This includes the protection of the conservation zone from adverse impacts from external sources (eg. pollution, inappropriate access, erosion, weed invasion, shading from adjacent buildings, vandalism and excess plant nutrients).
- retention of all indigenous flora species, with special emphasis on *Acacia pubescens* (Downy Wattle), *Senna odorata* and *Marsdenia viridiflora*
- retention of *Meridolan corneovirens* (Cumberland Plain Land Snail) and native fauna habitat that is suitable for a small isolated bushland.

Retention of the bushland in the conservation zone will additionally assist to provide visual amenity in the local area.

This management plan proposes that the above four desired outcomes can be achieved in the conservation area by addressing three related management issues:

- restoration and maintenance of the existing bushland
- introduction of a suitable fire regime
- control of impacts into the conservation area from external sources

A number of actions have been identified that are necessary to address the management issues (Table 2). Details of the actions are given below.

It is noted that the viability and conservation values of the management area can be increased by the appropriate retention and management of adjoining native vegetation. This issue is outside the scope of the current management plan.

Table 2 Management Issues & Actions

Desired outcome	*Management Issue*	*Actions*
Maintain natural ecological processes	Restore bushland	Control weeds Facilitate regeneration of cleared areas and tree open canopy Remove rubbish not required for temporary fauna habitat Monitor habitat and impacts
	Introduce fire regime	Burn bushland as per management plan Monitor regeneration after fire
	Control external impacts	Prevent unnecessary access by construction of fence Prevent overshading of bushland in winter by development control of Lot 11 Avoid disposal of solid rubbish, liquid waste and stormwater by Council conditions for developers of adjoining lots
Maintain plant species diversity	Restore bushland	see above. Monitor *Acacia pubescens* population Translocate *Senna odorata* and *Marsdenia viridiflora* to conservation zone
Maintain fauna habitat other	Restore bushland	see above. Retain sufficient plant litter, logs or suitable material for *Meridolum corneovirens* habitat Monitor *Meridolum corneovirens* population
	Control external impacts	see above.
Maintain/enhance landscape value	Restore bushland Retain existing mature trees along proposed extension of Lynn Parade	see above Council planning required

5.2 Details of Actions Required for Management of Conservation Zone

5.2.1 Bushland restoration and maintenance

Weed Control

The main intention of weed control is to eliminate species that pose a major threat to the viability of the native plant community or any individual species, and to prevent other species establishing large populations. It should be noted that it will be impossible to eliminate all introduced species. Continued regeneration of the native vegetation should create conditions that will disadvantage many of the pioneer weed species.

Although the condition of the bushland prior to clearing in 1997 is unknown, it appears that it was largely weed-free except for a 10-15 metre-wide band of mainly *Eragrostis curvula* along the western boundary and scattered concentrations of this species in the western half of Lot 10. The clearing of the site by earthmoving equipment has resulted in a temporary loss of much of the original ground cover and has enabled highly disbursable introduced species to colonise the site in relatively small populations.

The greatest concentration of weeds is on accumulated soil amongst two bulldozed log piles. The main species were *Pennesetum clandestinum* (Kikuyu), *Phytolacca octandra* (Ink Weed) and *Anredera cordifolia* (Madeira Vine). *Conyza albida* (Tall Fleabane) and *Solanum nigrum* (Blackberry Nightshade) were common.

It was considered initially that total removal of the spoil associated with the log dumps would be needed in order to control the weeds. A recent site inspection has indicated that significant damage may be done to the regenerating bushland during removal of the material by machines. In addition, native species have begun to regenerate among the logs. It is therefore proposed that the logs and soil be left as they are and the weeds be eliminated.

Most of the remainder of Lot 10 contains grouped to dense thickets of shrubs 1-2 metres tall with native ground covers and localised weed concentrations between. The most common weed species in these situations is *Eragrostis curvula* (African Love Grass). Other species, including *Chloris gayana* (Rhodes Grass), *Cynodon dactylon* (Couch grass), *Plantago lanceolata* (Lamb's Tongue), *Hypochaeris radicata* (Flatweed) and *Arctotheca calendula* (Capeweed) occur locally or in widespread low concentrations.

Dense concentrations of weeds and species that are likely to adversely affect native plant regeneration or future viability are to be eliminated. The species listed in Table 2 are to be targeted irrespective of their population size.

The list of target species should be revised periodically to account for colonisation by any additional species.

It is anticipated that weed control will comprise a concentrated initial phase (one to two years in duration) and subsequent low level control indefinitely.

All weed control work is to be done by qualified bushland regeneration personnel.

Facilitation of regeneration of cleared areas and tree open canopy
A few small areas were previously cleared of all vegetation and currently contain bare soil and early stages of regeneration. Weeds are common in some of these locations.

Most of these areas will probably regenerate naturally to bushland in time. Weed control will be necessary in some locations until the native plant community is restored.

Removal of Rubbish
Domestic and building rubbish has been dumped in various parts of the conservation zone. This is unsightly and some is likely to house vermin. All of this rubbish is to be removed except for that required for temporary habitat for the Large Land Snail (see below).

It is probable that when canopy trees are reestablished, they will provide adequate bark and leaf litter for snail habitat.

Care must be taken to ensure that none of the snails that may be present in the area are injured during rubbish removal and that damage to native plants is minimal.

Table 2 Target Species for Weed Control at Lot 10, 42A Jedda Road, Prestons

any species that are declared to be noxious in Liverpool City, plus

Arctotheca calendula (Capeweed)
Chloris gayana (Rhodes Grass),
Eragrostis curvula (African Love Grass)
*Lantana camara**
Ligustrum spp. (Privets)*
Olea europea ssp. *africana* (African Olive)*
Phytolacca octandra (Inkweed)
Solanum nigrum (Blackberry Nightshade)
Tradescantia fluminensis (Wandering Jew)*

* = widespread species that have not been recorded at the site yet, but may occur in the future.

This list should be revised periodically to account for colonisation by any additional species.

Rabbit Control
It is unclear whether the rabbits on the site will need to be controlled. They appear to be having little impact on the *Acacia pubescens*, but may result in the death of relocated *Senna odorata* and *Marsdenia viridiflora* as they are soft-leaved plants. It is unlikely they will affect *Meridolan corneovirens* in the existing circumstances.

At present rabbit control is not recommended, however this should be reassessed during routine monitoring.

Monitoring
Periodic monitoring is necessary in order to:

- assess the condition and vigour of the population of *Acacia pubescens*
- determine the presence/absence of *Meridolan corneovirens*
- assess the amount and distribution of weeds
- assess the progress of regeneration of native species, including after fire
- assess whether rabbit control is necessary
- determine whether the conservation zone has been affected by external impacts
- determine when management actions are needed for the above
- determine when fire should be used for management purposes

Routine monitoring is to comprise documentation of the above items and photographs taken from set points and bearings. Monitoring details need not be exhaustive, but must facilitate timely management decisions. It will occur at the following intervals:

- at the initial implementation of this management plan
- at the end of primary weed control (weed condition only)
- at 12 monthly intervals indefinitely

Survey of four set 5 x 5 metre quadrats is to be done. This will involve recording of all species, cover abundance and height classes of each species and comments on the condition, overshading and vigour of *Acacia pubescens*. Two of these are to be in existing largely cleared locations, the others in representative areas of bushland containing *Acacia pubescens*. Monitoring of the quadrats should occur at the initial implementation of this management plan (0 month), 12 months, 24, 36, 60, then 5 yearly.

The effects of the use of fire are proposed to be monitored (see below).

All monitoring is to be done by suitably qualified persons.

Translocation of Senna odorata & Marsdenia viridiflora
One of the conditions of approval of the proposed development is that these species, which are in bushland that is to be destroyed, are to be relocated into the conservation zone. It is believed that the best method of achieving the aim of this translocation is by establishing propagules of the original plants into the conservation zone.

It is proposed that 40 individuals of *Senna odorata* be grown from cuttings or seed previously collected from the site and that 10 individuals of *Marsdenia viridiflora* be grown from cuttings to be collected on site. The plants are to established into suitable

parts of the conservation zone (Lot10). Most of the *Senna odorata* should be largely planted in existing cleared locations, especially in the soil deposits associated with the log dumps. The *Marsdenia* should be planted into open shrubby locations, away from the relatively bare areas that are browsed by rabbits.

It will be essential that all tubestock plants are protected from rabbits. Protection should include planting in widespread locations and use of plant guards. Soil disturbance should be kept to the minimum required for planting.

5.2.2 Fauna Management

Management for fauna is basically limited to maintaining habitat suitable for the Cumberland Plain Land Snail (*Meridolan corneovirens*) and salvage of the snail from areas to be developed.

Management will entail management of the bushland as detailed in this plan. It is considered that conditions for the snail will be improved as the natural tree and shrub cover are restored. These will provide additional leaf and bark litter for cover for the snail and growth of fungi on which they feed (Stephanie Clarke, pers.comm).

Owing to the present general lack of suitable cover for the threatened snail, it is important that a small amount of the rubbish that is suitable habitat for the snail, is retained. The most suitable material that should be left on the ground is: solid sheet material such as vehicle body panels and timber sheets, beams or logs.

Council requires that *Meridolum corneovirens* be salvaged from the area to be cleared for development in Lot 11 (proposed Lots 5-8) and be relocated in the conservation zone (Lot 10). For this to be effective, it should be done immediately prior to clearing occurring.

Monitoring will involve determination of the presence/absence of *Meridolan corneovirens* and other *Meridolan* species that have recently been identified in similar habitat and are considered to be endangered in the Cumberland Plain. Monitoring is to occur in the year 2000 and then prior to ecological burns. At the latter events the presence of the snail in areas that are not to be burnt, should be determined. *Meridolan* that are found in the area to burnt should be translocated to a safe part of Lot 10.

Salvage and monitoring of *Meridolan corneovirens* is to be done by suitably qualified and experienced persons only.

5.2.3 Use of Fire

Fire would have been a component of the ecosystem prior to European settlement in the local area. It was probably necessary in order to periodically open the dense *Melaleuca nodosa* and *Melaleuca decora* canopy to enable the more light-demanding species to reestablish, including *Acacia pubescens*.

The draft recovery plan for *Acacia pubescens* (NPWS, in prep) indicates that relatively little is known about the fire regime that would be most suitable for this and other species. It is likely that a minimum fire frequency of ten years would be required for establishment of an adequate soil seedbank for some wattles (Auld & Myerscough, 1986) and other fire-sensitive species (Benson, 1985). Frequent fires may result in the loss of some species of obligate seeders (Muston, 1987, Thomas, 1994).

Details regarding the best fire intensity, duration and seasonality are similarly scanty at present.

Based on the work of the above authors, it is likely that a suitable fire regime would be variable in frequency (possibly between 5 and 30 years), and intensity and duration, but mainly occur between late spring and autumn.

Because Lot 10 has been cleared fairly recently, it is possible that much of the soil seedbank has been removed or has been activated. It is therefore proposed that the first planned fire not occur before 2012 (c.15 years after clearing). Details regarding fire intensity, duration and time of year should be assessed nearer the time, when more research on these issues has been done.

In order to retain habitat at the site, it is proposed that no more than 30% of Lot 10 be burnt in any five year period. The retention of 60% habitat should be adequate for preservation of the Cumberland Plain Land Snail (Stephanie Clarke, pers.comm)(see comment above regarding monitoring and translocation).

It is likely that sections of Lot 10 near the extended Lynn Parade will be burnt more frequently by unplanned fires lit by vandals, especially if the fence is damaged. These fires should be recorded and the area not planned to be burnt for 10-30 years. It is possible that a high frequency of unplanned could result in the margin being excluded for planned fire.

Periodic inspection and maintenance of the fence is considered to be important in order to minimise inappropriate fire and other impacts.

Monitoring of fire should include records of the date, time, intensity and extent of burns, and details of the resulting regeneration.

5.2.4 Control of External Impacts

Council require that a 1.8 metre-tall fence be constructed around the conservation zone. This should minimise unnecessary access into Lot 10 and damage to bushland via rubbish dumping. Based on the damage that has been done to the existing fences in the vicinity, it is likely that periodic inspection and repair will be required.

Potential overshadowing of the northern margin of the bushland has been dealt with by Council's requirement that a buffer zone be established in proposed Lots 4-8 inclusive, adjacent to Lot 10. No shading structures are to be built above an imaginary

line drawn upward and outward at 35 degrees from the lot boundaries, oriented perpendicular to the boundary alignment.

The buffer zone will also be a fire control buffer zone.

Disposal of all waste and stormwater is to occur away from Lot 10 to prevent any negative impact on the conservation zone. This should not be a problem for the current development area, as it naturally drains towards Jedda Road.

5.3 Comments on Management of *Acacia pubescens*

5.3.1 *Conservation requirements*

The conservation requirements of this species have not been fully determined. Concerns exist about the ability of the species to propagate from seed, and the potential lack of genetic diversity in remaining populations. A recovery plan is being prepared by NPWS and is currently at the draft stage. It is currently unable to fully address management requirements for *Acacia pubescens* owing to a lack of information regarding these issues. Owing to the need for additional research work to be done, the draft recovery plan recommends that no further clearing of populations of *Acacia pubescens* should occur.

Acacia pubescens, and wattles in general, tend to be pioneers that occur in open or disturbed locations. They appear to require high levels of sunlight and become senescent in locations of increasing shade. Many of the species are short-lived (5-20 years). Their perpetuation depends on the production masses of seed that have long dormant viability, and are readily germinated after disturbance. *Acacia pubescens* is able to survive some disturbance by resprouting from living root system. This ability may also allow the species to increase its life span indefinitely, however this is currently unknown.

Appendix 3 of the draft recovery plan for *Acacia pubescens* (Conservation Guidelines) includes the following guidelines:

Part 2: Guidelines for private landholders:

- promote recovery of *A. pubescens* to a position of viability in nature
- conservation on private land is vital for conservation and recovery of species
- planning and active management and protection of sites is essential
- retention of connection with other natural habitat
- buffer zones may be appropriate
- plans of management, Property Management Plans or Voluntary Conservation Agreements may be appropriate

5.3.2 *Viability of population in study area*

Weeds currently comprise a minor component of the native plant community. Based on the inspection of Lot 10 on 11 June, 1999 it appears unlikely that introduced species will have a significant impact on the *Acacia pubescens*.

The most likely significant long-term threat to the *Acacia* is from shading, whether from *Melaleuca* spp. The developing tree canopy may cause thinning of *Acacia pubescens*.

5.4 Comments on management of *Meridolan corneovirens*

Conservation Requirements

The habitat of the Cumberland Plain Land Snail has been drastically reduced due to clearing and urban development pressures, resulting in a number of isolated, remnant, disjunct populations. The snail is linked with the dry woodlands and forests on the Cumberland Plain. These woodlands and forests have been listed under Part 3 Schedule 1 of the *Threatened Species Conservation Act 1995* as an Endangered Ecological Community. This listing has been given because there is only around 6% of this woodland type remaining, the majority of which occurs on private land. Neither this community nor the habitat of the Cumberland Plain Land Snail is considered to be well conserved.

At the time of report preparation, no areas containing Cumberland Plain Land Snail were listed under Part 3 Division 1 of the *Threatened Species Conservation Act 1995* as critical habitat in New South Wales.

The Large Land Snail is one of a few native invertebrates listed on Schedules 1 or 2 of the *Threatened Species Conservation Act 1995*. This snail is restricted to the Central Coast region, centred on Sydney, with its populations being very small and scattered (Phil Coleman, Australian Museum, pers.comm.). This species occurs within dry sclerophyll forests, (most commonly found in Cumberland Plain Woodland) where it shelters under leaf litter, logs, urban refuse and decaying matter. It is a detritus feeder, and is often found feeding on fungi. Breeding is related to climatic conditions, this species being dependant on precipitation for breeding opportunities (Coleman, pers.comm.). Laying its eggs in soil depressions under logs or under leaf litter, the eggs take approximately two weeks to hatch. Little else is known about the life cycle of this snail, but it is believed that this species lives for around two to three years, being sexually mature at the end of its first year (Coleman, pers.comm.).

Threats to the occurrence of this species include clearing of bushland and urban expansion (NSW Scientific Committee, final determination notes). As areas of dry sclerophyll forest are cleared, this species continues to become displaced, isolated, fragmented and locally extinct. As populations of this species are already very small and scattered, removal of any vegetation which contains this species is considered to pose a significant impact.

Little is known regarding dispersal or foraging movements of this species, and how much area is required to prevent the inbreeding of a populations.

No threat abatement plans or key threatening processes relating to this species have been gazetted for inclusion in the *Threatened Species Conservation Act 1995*.

Although insufficient is known about the biology of this species, the size or connectivity of habitat required to ensure viability of the snail populations, it is possible that relatively large areas beyond the subject area would need to be retained, and connectivity ensured.

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Appendix 1

PLANT SPECIES RECORDED AT 42A JEDDA ROAD, PRESTONS

Plant Community: *Eucalyptus fibrosa* Shale/Gravel Transition Forest

Trees				
Fabaceae	Acacia decurrens	Green Wattle	o	
Myrtaceae	Eucalyptus fibrosa	Broad-leaved Ironbark	v	
	E. longifolia	Woollybutt	r	
	E. sideroxylon	Mugga Ironbark	r	V3
	E. tereticornis	Forest Red Gum	r	
	Melaleuca decora	a paperbark	c	
Santalaceae	Exocarpos cupressiformis	Native Cherry	r	
Shrubs				
Asteraceae	Olearia microphylla		r	
	Ozothamnus diosmifolius	White Dogwood	o	
Celastraceae	Maytenus silvestris	Narrow-leaved Orangebark	o	V3
Dilleniaceae	Hibbertia aspera	Rough Guinea Flower	r	
Epacridaceae	Lissanthe strigosa	Peach Heath	r	
Fabaceae	Daviesia ulicifolia		r	
(Faboideae)	Dillwynia sieberi		o	
	Indigofera australis	Australian Indigo	o	
(Mimosoideae)	Acacia falcata	Sickle-leaf Wattle	r	
	A. pubescens	Downy Wattle	c	S2
(Caesalpinioideae)	Senna odorata		r	Reg
	*S. pendula var. glabrata	Cassia	r	
Myrtaceae	Callistemon linearis	Narrow-leaved Bottlebrush	o	
	Melaleuca erubescens		r	
	M. nodosa		v	
Oleaceae	Notelaea longifolia	Large Mock Olive	r	
Pittosporaceae	Bursaria spinosa	Black Thorn	o	
Proteaceae	Hakea sericea	Silky Hakea	adj	
Rhamnaceae	Cryptandra spinescens		o	V3
	Pomaderris lanigera		r	V3
Sterculiaceae	Rulingia dasyphylla		r	V3
Thymeliaceae	Pimelea linifolia	Common Rice Flower	adj	
Herbs				
Fern				
Sinopteridaceae	Chielanthes sieberi	Rock Fern		o
Angiosperms - Dicots				
Acanthaceae	Brunoniella australis	Blue Trumpet	r	
Amaranthaceae	*Amaranthus viridus	Green Amaranth	r	

Apiaceae	Hydrocotyle peduncularis		r	V3
Asteraceae	*Actotheca calendula	Capeweed	c	
	*Bidens pilosa	Cobblers Pegs	r	
	Calotis cuneifolia	Blue Burr Daisy	r	V3
	*Cirsium vulgare	Scotch Thistle	r	
	*Conyza albida	Tall Fleabane	r	
	Cotula australis		c	
	Euchiton involucratum		o	V3
	*Hypochaeris radicata	Flat Weed	o	
	Senecio hispidulus			r
	V3			
	*S. madagascariensis	Fire Weed	v	
	S. quadridentatus		r	V3
	*Sonchus oleraceus	Sow Thistle	c	
	*Taraxacum officinale	Dandelion	o	
	Vernonia cinerea		o	
	Vittadinia cuneata			
	var. cineata		r	V2
Brassicaceae	*Lepidium africanum		o	
Campanulaceae	Wahlenbergia gracilis	Native Bluebell	r	
	W. sp.	Native Bluebell	o	
Chenopodiaceae	Atriplex ?semibaccata	Saltbush	r	V3
	Einadia hastata		o	
	Einadia trigonos	Fishweed	r	V3
Convolvulaceae	Dichondra repens	Kidney Weed	o	
Crassulaceae	*Crassula sp.		r	
Euphorbiaceae	Poranthera microphylla		r	
Fabaceae	Desmodium varians		o	
Geraniaceae	Pelargonium inodorum		v	V3
Haloragaceae	Gonocarpus tetragyna		r	
Hypericaceae	*Hypericum perforatum	St Johns Wort	c	
Lamiaceae	*Stachys arvensis	Stagger Weed	r	
Malvaceae	*Modiola caroliniana		o	
	*Sida rhombifolia	Paddys Lucerne	o	
Oxalidaceae	*Oxalis sp.			r
Phytolaccaceae	*Phytolacca octandra	Ink Weed	o	
Plantaginaceae	Plantago gaudichaudii		r	V3
	*P. lanceolata	Lambs Tongue		c
Rubiaceae	Opercularia diphylla		o	
Scrophulariaceae	Veronica plebeia	Trailing Speedwell	o	
Solanaceae	*Solanum nigrum	Blackberry Nightshade	c	
Stackhousiaceae	Stackhousia viminea		r	
Verbenaceae	*Verbena bonariensis/rigida	Purple Top	c	

Angiosperms - Monocots

Anthericaceae	Arthropodium milleflorum	Vanilla Lily		r
	V3			
Commelinaceae	Commelina cyanea	Blue Wandering Jew		r
Cyperaceae	Lepidosperma laterale	Broad Sword Sedge	r	

Lomandraceae	Lomandra filiformis			
	ssp. filiformis		v	
	L. multiflora		o	
Phormiaceae	Dianella longifolia			r
	D. revoluta		o	
Poaceae	Aristida ramosa	Three-awned Grass	o	
	*Bromus uniloides	Prairie Grass		o
	*Chloris gayana	Rhodes Grass	o	
	Cymbopogon refracta	Barb Wire Grass	r	
	*Cynodon dactylon	Couch Grass	cl	
	Danthonia linkii var. fulva	Wallaby Grass		r
	Digitaria parviflorum	Finger Grass	o	
	Dichelachne micrantha	Plume Grass	o	
	*Ehrharta erecta	Veldt Grass	ol	
	*Eleusine indica		r	
	Entolasia stricta	Wiry Panic	v	
	*Eragrostis cuvula	African Love Grass	v	
	Microlaena stipoides	Weeping Grass	v	
	Panicum effusum		r	
	P. simile		c	
	Paspalidium distans		o	
	*Paspalum dilatatum	Paspalum	o	
	*Pennesetum clandestinum	Kikuyu	cl	
	*Setaria gracilis	Slender Pigeon Grass	c	
	Stipa sp.	Spear Grass	o	
	Themeda australis	Kangaroo Grass	adj	
Vines				
Dicots				
Asclepiadaceae	*Araujia hortorum	Moth Vine	r	
	Marsdenia viridiflora		r	Reg
	Tylophora barbata	Bearded Tylophora	r	
Baselliaceae	*Anredera cordifolia	Madeira Vine	ol	
Convolvulaceae	Polymera calycina		o	V3
Fabaceae	Glycine tabacina		o	
Lauraceae	Cassytha pubescens	Devils Twine	r	
Pittosporaceae	Billardiera scandens		r	
Monocot				
Asparagaceae	*Myrsiphyllum asparagoides	Bridal Veil Creeper		ol
Mistletoes				
Loranthaceae	Amyema gaudichaudii		r	V3
	A. miquelii		adj	V3

KEY

Indicative frequency of occurrence

v = very common
c = common
o = occasional
r = rare

l = localised occurrence/s
* = introduced species

adj = recorded adjacent to study area

S2 = listed in Schedule 2 of the Threatened Species Conservation Act, 1997
Reg = High regional conservation significance
V = vulnerable in Western Sydney, digit indicates number of conservation reserves in which it has been recorded in region

APPENDIX 2

Fauna observed, or known to occur within ten kilometres of 42A Jedda Road, Prestons

Source of Record

1 = Species Recorded During Present Study

2 = NPWS (1998)

3 = LesryK (1996a)

4 = LandScope (1996)

5 = UBMC (1997)

6 = LesryK (1996b)

7 = LesryK (1996c)

8 = NPWS (1997)

Key

\+ Denotes species of regional significance NPWS (1997)

\# Denotes species under the Threatened Species Conservation Act 1995

* Denotes introduced species

Common Name	*Scientific Name*	*Report*
+Stubble Quail	Coturnix pectoralis	8
+Brown Quail	Coturnix ypsilophora	8
+Painted Button-quail	Turnix varia	8
Australian Pelican	Pelecanus conspicillatus	7,8
Darter	Anhinga melanogaster	8

Pied Cormorant	Phalacrocorax varius	8
Little Pied Cormorant	Phalacrocorax melanoleucos	8
Great Cormorant	Phalacrocorax carbo	8
Little Black Cormorant	Phalacrocorax sulcirostris	8
+Great Crested Grebe	Podiceps cristatus	8
Hoary-headed Grebe	Poliocephalus poliocephalus	8
Australasian Grebe	Tachybaptus novaehollandiae	7,8
Black Swan	Cygnus atratus	8
Pacific Black Duck	Anas superciliosa	2,3,5,7,8
* Mallard	Anas platyrhynchos	7,8
Grey Teal	Anas gracilis	7,8
Chestnut Teal	Anas castanea	8
Hardhead	Aythya australis	8
Australian Wood Duck	Chenonetta jubata	2,5,7,8
Dusky Moorhen	Gallinula tenebrosa	2,3,5,7,8
Purple Swamphen	Porphyrio porphyrio	2,5,7,8
Eurasian Coot	Fulica atra	2,7,8
White-necked Heron	Ardea pacifica	8
White-faced Heron	Egretta novaehollandiae	2,3,5,8
Cattle Egret	Ardea ibis	8
+Great Egret	Ardea alba	8
+Nankeen Night Heron	Nycticorax caledonicus	8
# Black Bittern	Ixobrychus flavicollis	8
Australian White Ibis	Threskiornis molucca	2,5,8
Straw-necked Ibis	Threskiornis spinicollis	1,8
Royal Spoonbill	Platalea regia	7,8
Yellow-billed Spoonbill	Platalea flavipes	8
+Common Sandpiper	Actitis hypoleucos	8
# Bush Stone-curlew	Burhinus grallarius	2,8
Masked Lapwing	Vanellus miles	2,7,8
Black-fronted Dotterel	Elseyornis melanops	8
Silver Gull	Larus novaehollandiae	8
Black-shouldered Kite	Elanus axillaris	3,6,8
Black Kite	Milvus migrans	8
+Whistling Kite	Haliastur sphenurus	8
+White-bellied Sea-Eagle	Haliaeetus leucogaster	8
+Wedge-tailed Eagle	Aquila audax	8
+Little Eagle	Hieraaetus morphnoides	2,8
+Pacific Baza	Aviceda subcristata	8
Collared Sparrowhawk	Accipter cirrhocephalus	8
+Grey Goshawk	Accipiter novaehollandiae	2,3,5,8
Spotted Harrier	Circus assimilis	2,8
Swamp Harrier	Circus approximans	8
Black Falcon	Falco subniger	2,8
Australian Hobby	Falco longipennis	8
Brown Falcon	Falco berigora	8
Nankeen Kestrel	Falco cenchroides	8
* Rock Dove	Columba livia	1,3,6,8
* Spotted Turtle-Dove	Streptopelia chinensis	1,2,3,5,6,8

+Common Bronzewing	Phaps chalcoptera	8
Crested Pigeon	Ocyphaps lophotes	2,5,6,8
+Peaceful Dove	Geopelia striata	8
Wonga Pigeon	Leucosarcia melanoleuca	8
# Glossy Black-Cockatoo	Calyptorhynchus lathami	8
Yellow-tailed Black-Cockatoo	Calyptorhynchus funereus	8
Galah	Eolophus roseicapilla	1,2,3,4,5,6,7,8
Long-billed Corella	Cacatua tenuirostris	8
Sulphur-crested Cockatoo	Cacatua galerita	1,2,3,4,5,6,7,8
Rainbow Lorikeet	Trichoglossus haematodus	1,2,3,5,7,8
Little Lorikeet	Glossopsitta pusilla	8
Australian King Parrot	Alisterus scapularis	8
Cockatiel	Nymphicus hollandicus	8
# Swift Parrot	Lathamus discolor	8
Crimson Rosella	Platycercus elegans	4,8
Eastern Rosella	Platycercus eximius	2,5,7,8
Australian Ringneck	Barnardius zonarius	8
Red-rumped Parrot	Psephotus haematonotus	5,7,8
Pallid Cuckoo	Cuculus pallidus	8
Fan-tailed Cuckoo	Cuculusflabelliformis	8
Horsfield's Bronze-Cuckoo	Chrysococcyx basalis	8
Shining Bronze-Cuckoo	Chrysococcyx lucidus	8
Brush Cuckoo	Cuculus variolosus	8
Channel-billed Cuckoo	Scythrops novaehollandiae	2,5,8
Southern Boobook	Ninox novaeseelandiae	8
Tawny Frogmouth	Podargus strigoides	8
Australian Owlet-nightjar	Aegotheles cristatus	8
+White-throated Needletail	Hirundapus caudacutus	8
+Azure Kingfisher	Alcedo azurea	4,8
Laughing Kookaburra	Dacelo novaeguineae	2,3,4,5,8
Red-backed Kingfisher	Todiramphus pyrrhopygia	8
Sacred Kingfisher	Todiramphus sancta	2,4,5,8
Rainbow Bee-eater	Merops ornatus	8
Dollarbird	Eurystomus orientalis	4,5,8
Superb Lyrebird	Menura novaehollandiae	8
Varied Sittella	Daphoenositta chrysoptera	4
White-throated Treecreeper	Cormobates leucophaeus	8
+Brown Treecreeper	Climacteris picumnus	8
Superb Fairy-wren	Malurus cyaneus	1,2,3,4,5,6,8
Varigated Fairy-wren	Malurus lamberti	8
Spotted Pardalote	Pardalotus punctatus	2,4,5,7,8
+Striated Pardalote	Pardalotus striatus	8
+Rock Warbler	Origma solitaria	8
White-browed Scrubwren	Sericornis frontalis	2,3,4,5,8
Large-billed Scrubwren	Sericornis magnirostris	8
+Chestnut-rumped Heathwren	Hylacola pyrrhopyia	8
+Speckled Warbler	Chthonicola sagittata	8
Weebill	Smicrornis brevirostris	2,3,8
White-throated Gerygone	Gerygone olivacea	8

Western Gerygone	Gerygone fusca	8
Brown Thornbill	Acanthiza pusilla	3,4,8
Yellow Thornbill	Acanthiza nana	1,2,3,5,8
Striated Thornbill	Acanthiza lineata	2,5,8
+Buff-rumped Thornbill	Acanthiza reguloides	8
+Yellow-rumped Thornbill	Acanthiza chrysorrhoa	8
Red Wattlebird	Anthochaera carunculata	1,2,4,5,6,8
Brush Wattlebird	Anthochaera chrysoptera	2,4,5,7,8
Noisy Friarbird	Philemon corniculatus	2,4,5,8
# Regent Honeyeater	Xanthomyza phrygia	8
Bell Miner	Manorina melanophrys	2,5,8
Noisy Miner	Manorina melanocephala	1,2,3,5,6,8
Lewins Honeyeater	Meliphaga lewinii	1,8
Yellow-faced Honeyeater	Lichenostomus chrysops	1,2,4,5,8
White-eared Honeyeater	Lichenostomus leucotis	2,3,8
Yellow-tufted Honeyeater	Lichenostomus melanops	8
+Fuscous Honeyeater	Lichenostomus fuscus	8
White-plumed Honeyeater	Lichenostomus penicillatus	2,3,5,6,7,8
+Black-chinned Honeyeater	Melithreptus gularis	8
Brown-headed Honeyeater	Melithreptus brevirostris	4,8
White-naped Honeyeater	Melithreptus lunatus	8
New Holland Honeyeater	Phylidonyris novaehollandiae	2,4,5,8
+Tawny-crowned Honeyeater	Phylidonyris melanops	8
Eastern Spinebill	Acanthorhynchus tenuirostris	2,4,5,8
Scarlet Honeyeater	Myzomela sanguinolenta	8
Eastern Whipbird	Psophodes olivaceus	2,5,8
Spotted Quail-thrush	Cinclosoma punctatum	8
Rose Robin	Petroica rosea	8
+Flame Robin	Petroica phoenicea	2,8
+Hooded Robin	Melanodryas cucullata	8
Eastern Yellow Robin	Eopsaltria australis	2,4,5,8
+Jacky Winter	Microeca fascinans	8
Rufous Fantail	Rhipidura rufifrons	2,8
Grey Fantail	Rhipidura fuliginosa	2,3,5,8
Willie Wagtail	Rhipidura leucophrys	2,3,5,6,7,8
+Crested Shrike-tit	Falcunculus frontatus	8
Grey Shrike-thrush	Colluricincla harmonica	2,3,5,8
Golden Whistler	Pachycephala pectoralis	8
Rufous Whistler	Pachycephala rufiventris	2,5,8
Leaden Flycatcher	Myiagra rubecula	8
Satin Flycatcher	Myiagra cyanoleuca	2,8
+Restless Flycatcher	Myiagra inquieta	8
Magpie-lark	Grallina cyanoleuca	1,2,3,5,6,7,8
Spangled Drongo	Dicrurus bracteatus	8
Olive-backed Oriole	Oriolus sagittatus	4,8
Figbird	Sphecotheres viridis	2,8
Satin Bowerbird	Ptilonorhynchus violaceus	8
Black-faced Cuckoo-shrike	Coracina novaehollandiae	1,2,3,4,5,6,7,8
+White-bellied Cuckoo-shrike	Coracina papuensis	8

Cicadabird	Coracina tenuirostris	8
+White-winged Triller	Lalage sueurii	2,8
White-browed Woodswallow	Artamus superciliosus	2,8
Dusky Woodswallow	Artamus cyanopterus	8
Grey Butcherbird	Cracticus torquatus	2,5,8
Pied Butcherbird	Cracticus nigrogularis	3,8
Australian Magpie	Gymnorhina tibicen	2,5,6,7,8
Pied Currawong	Strepera graculina	1,2,4,5,8
Grey Currawong	Strepera versicolor	8
Australian Raven	Corvus coronoides	1,2,3,4,5,6,7,8
Australian Raven	Corvus coronoides	8
Little Raven		8
+White-winged Chough	Corcorax melanorhamphos	8
White-backed Swallow	Cheramoeca leucosternus	8
Welcome Swallow	Hirundo neoxena	1,2,3,4,5,6,7,8
Tree Martin	Hirundo nigricans	2,5,8
Fairy Martin	Hirundo ariel	6,8
Richard's Pipit	Anthus novaeseelandiae	8
Clamorous Reed-warbler	Acrocephalus stentoreus	2,5,8
Golden-headed Cisticola	Cisticola exilis	6,8
Tawny Grassbird	Megalurus timoriensis	1,6,8
* House Sparrow	Passer domesticus	2,3,4,5,6,8
* European Greenfinch	Carduelis chloris	8
* European Goldfinch	Carduelis carduelis	2,3,6,8
Double-barred Finch	Taeniopygia bichenovii	2,5,8
+Zebra Finch	Taeniopygia guttata	8
Red-browed Finch	Neochmia temporalis	2,3,5,8
+Beautiful Fire-tail	Stagonopleura bella	8
* Nutmeg Mannikin	Lonchura punctulata	8
+Chestnut-breasted Mannikin	Lonchura castaneothorax	8
Mistletoebird	Dicaeum hirundinaceum	4,8
Silvereye	Zosterops lateralis	2,3,4,5,8
* Red-whiskered Bulbul	Pycnonotus jocosus	2,3,4,5,8
* Common Blackbird	Turdus merula	2,5,8
* Common Myna	Acridotheres tristis	1,2,3,4,5,6,8
* Common Starling	Sturnus vulgaris	1,2,3,5,6,8

MAMMALS

Short-beaked Echidna	Tachyglossus aculeatus	8
Brown Antechinus	Antechinus stuartii	8
Long-nosed Bandicoot	Perameles nasuta	2,8
Common Wombat	Vombatus ursinus	8
Common Ringtail Possum	Pseudocheirus peregrinus	8
Greater Glider	Petauroides volans	8
Sugar Glider	Petaurus breviceps	2,8
Common Brushtail Possum	Trichosurus vulpecula	2,4,5,7
Eastern Pygmy Possum	Cerartetus nanus	8
Red-necked Pademelon	Thylogale thetis	8

Eastern Grey Kangaroo	Macropus giganteus	8
Common Wallaroo	Macropus robustus	8
Red-necked Wallaby	Macropus rufogriseus	2
Swamp Wallaby	Wallabia bicolor	2,4,8
Grey-headed Flying Fox	Pteropus poliocephalus	2,3,4,8
# Large-eared Pied Bat	Chalinolobus dwyeri	8
Gould's Wattled Bat	Chalinolobus gouldii	2,5,8
Chocolate Wattled Bat	Chalinolobus morio	2,5,8
Freetail Bat	Mormopterus sp.1	5
# Eastern Freetail-bat	Mormopterus norfolkensis	2,5
# Common Bentwing-bat	Miniopterus schreibersii	8
# Large-footed Myotis	Myotis adversus	8
Lesser Long-eared Bat	Nyctophilus geoffroyi	8
Gould's Long-eared Bat	Nyctophilus gouldi	8
# Greater Broad-nosed Bat	Scoteanax rueppellii	5,8
Eastern Broad-nosed Bat	Scotorepens orion	2,3,8
White-striped Freetail-bat	Nyctinomus australis	2,3,5,8
Little Forest Bat	Vespadelus vulturnus	2,5,8
Bush Rat	Rattus fuscipes	2,8
Swamp Rat	Rattus lutreolus	2,8
* Black Rat	Rattus rattus	2,8
* House Mouse	Mus musculus	1,3,8
* Rabbit	Oryctolagus cuniculus	1,2,3,45,8
* Brown Hare	Lepus capensis	8
* Fox	Vulpes vulpes	1,2,3,4,5,8
* Feral Cat	Felis catus	2,3,5,8
* Dog	Canis familiaris	1,2,3,5,8

REPTILES

Eastern Snake-necked Turtle	Chelodina longicollis	2,3,8
Wood Gecko	Diplodactylus vittatus	2,8
Lesueur's Velvet Gecko	Oedura lesueurii	4,8
Southern Leaf-tailed Gecko	Phyllurus platurus	4
Common Scaly-foot	Pygopus lepidopodus	2,8
Jacky Lizard	Amphibolurus muricatus	2,3,4,8
Eastern Water Dragon	Physignathus lesueurii	2,3,8
Bearded Dragon	Pogona barbata	8
Mountain Dragon	Tympanocryptis diemensis	8
Lace Monitor	Varanus varius	8
Wall Skink	Cryptoblepharus virgatus	4,8
Striped Skink	Ctenotus robustus	2,8
Copper-tailed Skink	Ctenotus taeniolatus	4,8
Eastern Water Skink	Eulamprus quoyii	2,3,5,8
Grass Skink	Lampropholis delicata	2,4,5,6,7,8
Garden Skink	Lampropholis guichenoti	2,3,4,5,6,8
Eastern Blue-tongued	Tiliqua scincoides	2,4,8
Three-toed Skink	Saiphos equalis	8
Blind or Worm Snake	Ramphotyphlpos nigrescens	8

Red-naped Snake	Furina diadema	2,8
Black-bellied Swamp Snake	Hemiaspis signata	8
Red-bellied Black Snake	Pseudechis porphyriacus	2,8
Eastern Brown Snake	Pseudonaja textilis	8
Bandy Bandy	Vermicella annulata	2,8

AMPHIBIANS

Common Eastern Froglet	Crinia signifera	1,2,3,4,5,7,8
Eastern Banjo Frog	Limnodynastes dumerilii	8
Ornate Burrowing Frog	Limnodynastes ornatus	8
Brown-striped Frog	Limnodynastes peroni	2,3,4,5,8
Spotted Grass Frog	Limnodynastes tasmaniensis	8
# Green and Golden Bell Frog	Litoria aurea	8
Green Tree Frog	Litoria caerulea	8
Blue Mountains Tree Frog	Litoria citropa	8
Bleating Tree Frog	Litoria dentata	4,8
Eastern Dwarf Tree Frog	Litoria fallax	8
Freycinet's Frog	Litoria freycineti	8
Broad-palmed Frog	Litoria latopalmata	8
Leseur's Tree Frog	Litoria lesueuri	8
Peron's Tree Frog	Litoria peronii	2,5,8
Verreaux's Tree Frog	Litoria verreauxi	8
Barred Frog	Mixophyes balbus	8
Haswell's Frog	Paracrinia haswelli	8
Brown Toadlet	Pseudophryne bibronii	8
Smooth Toadlet	Uperoleia laevigata	8

MOLLUSC

# Cumberland Plain Land Snail	Meridolum corneovirens	1